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Control and Improvement of the Composition of Hollow Ware

By Oscar Knapp

THERE are two methods to make the best glass at the lowest cost. One is the practical way, based upon several centuries of experience and on a collection of good rules and tried out glass batches. The other is only a few decades old, and is based on scientific knowledge, laws and theories. The object of the glass industry can be reached most easily when these two ways are combined. The scientifically trained glass technologist must bring his knowledge and theories in harmony with the experience of practice, and must work out a method, based on the results of scientific investigation, tried out in practice.

The practical glassmaker who possesses a number of tried recipes and formulas, inherited from father to son, should cause them to be tested by means of scientific methods of control, to see if the two methods are in agreement or not.

In practice it occurs very rarely that a glass batch is newly constructed without any help. In most cases glass batches are partly obtained from the literature, often from glassmakers. Samples of glass can also be helpful, as they can be analyzed and from the analysis the desired batch can be calculated. In all cases it is absolutely necessary that every glassmaker, whether scientist or practical man, should learn a method with the aid of which glass batches can be controlled and modified in a systematic way. In the past such a method of control could only be accomplished by the making of experimental melts, and the changes could only be effected step by step.

During the past decades glass science has developed to the point where this control and improvement can be effected through theoretical means without experimental melts. In this article a new method is worked out, that can be utilized easily in practical work. This method is based on the theory that glass, while in the molten condition, is a true solution. As in solutions, the constituents of glass retain their properties, and it is therefore possible to calculate the properties of glasses from a knowledge of the properties of the components.

The actual components of glass are unknown, although numerous hypotheses have been put forward. However, there are certain properties derived from the glass oxides as found by analysis. Research concerning certain properties and the chemical composition as found by analysis has proved that there is a certain relationship, by which the former can be derived from the latter.

The linear relationship between the glass forming substances and the properties makes possible the use of the graphical method. This method has the advantage that it allows one to survey the whole field of all of the glasses from the standpoint of the property in question. The graph thus obtained serves as a dependable guide, like a geographical map, even in unknown territories.

The diagrams which show the relationship between the properties and the glass forming oxides can be partial and total. The former give only a partial picture of all possible glasses. The latter comprise the whole field, of the known and also of the yet unknown, but possible glasses.

The total diagrams give a general picture with which one can obtain a quick orientation. The ordinates can be chosen in different ways. To obtain a uniform diagram we select as ordinates the glassforming oxides and show the values of the properties as points in the diagram. These points will form lines, that will be parallel if the properties are additive. They indicate the relationship between the chemical composition of the glass and its properties and can serve to draw theoretical conclusions for the control and improvement of glasses.

Without considering quartz glass, in which only one component is present, we find only in rare cases glasses composed of two components. In this case the glass diagram becomes a right angle, in which the two ordinates represent the two glass-forming oxides. The points located in the field represent the values of the properties of the glasses formed. It should be observed, however, that we are only interested in that part of the field, situated between the limits of devitrification.

We will not consider further the case of only two glass-

forming oxides. This only occurs in optical glasses, in the case of very heavy flint glasses, consisting of lead oxide (PbO) and silica (SiO_2). For the consideration of hollow ware, this field is of no interest.

The simplest case in hollow ware is that of three glass-forming oxides, SiO_2, Na_2O and CaO. Impurities or traces of MgO, K_2O, Fe_2O_3, or Al_2O_3 can be neglected. The diagram in that case is a triangle. The sides represent the percentages of the glass-forming oxides. It is possible to use a

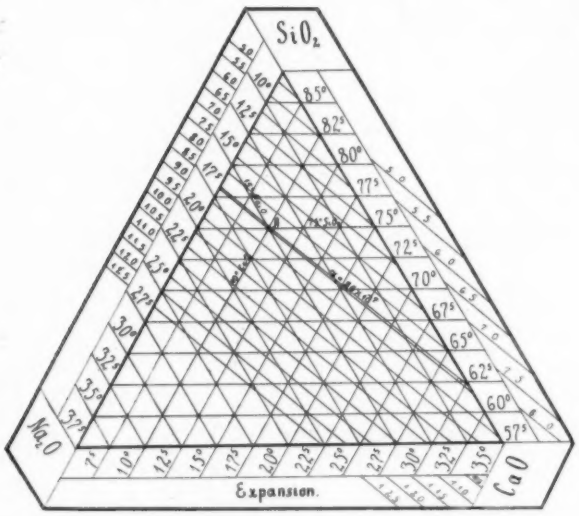

FIG. 1

right angle in this case also. Zschimmer is of the opinion that the use of an equilateral triangle is not suitable for practical use. We prefer however to use an equilateral triangle, instead of the more frequently used right angular, unequilateral triangle. This is because the values in the case of the latter triangle are not the same on the hypothenuse as on the cathetus. The length which on the cathetus represents 1 is on the hypothenuse 1.4. The directions in various parts of the field are therefore unequal.

Table 1

Qualities	C I.	1 II.	a III.	s IV.	s V.
Expansion	till 50	50–75	75–100	100–125	over 125 $\times 10^{-7}$
Density	till 2.40	2.40–2.45	2.45–2.50	2.50–2.55	over 2.55
Elasticity	till 5000	5000–6000	6000–7000	7000–8000	over 8000
Heat conductivity	over 205	200–205	195–200	190–195	till 190 $\times 10^{-7}$
Tensile strength	over 950	900–950	850–900	800–850	till 800
Physical endurance ...	over 15	12–15	9–12	6–9	till 6

Any difficulties in the use of the equilateral triangle will disappear upon frequent use.

To make possible the easy and certain reading of the properties, the triangle is given two borders. The first border shows the percentages of the glass-forming oxides, the second border gives a scale of the properties. The field of the glassy state is taken as given by Gelstharp and Parkinson, and according to Zschimmer and Dietzel. Fig. 1 shows such a triangle, which indicates that the composition of a glass shown as point A is the following:

SiO_2	75.00 Percent
Na_2O	15.00 Percent
CaO	10.00 Percent

On the scale of the outside border it can be seen that this glass has a coefficient of expansion of 85×10^{-7}.

These graphical representations enable us to obtain a rapid view of certain glass compositions and to change them and improve them in any desired direction. In the following are given a number of examples dealing with important properties of glasses, showing the use of this method.

In considering the composition of the glass, it is not necessary to determine the properties quantitatively. It is sufficient if qualitative groups or classes are established, which indicate the extent of the property involved. With regard to some properties it has become customary to divide glasses into five groups of which class I indicates very good glasses, and class V very poor glasses. The division in classes and the limiting values are shown in Table 1. The object of

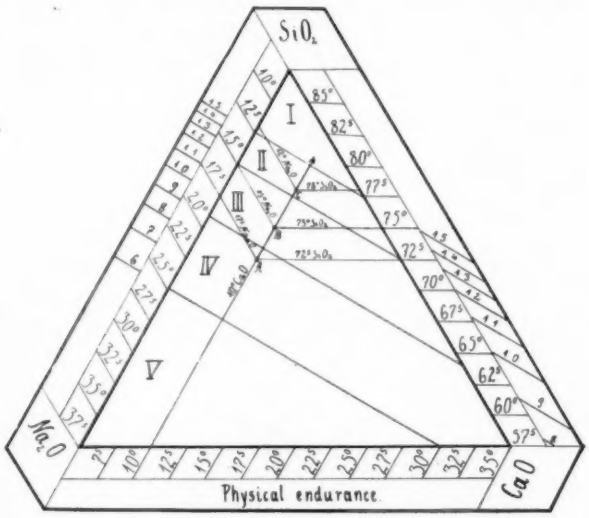

FIG. 2

improvement of a glass lies in bringing its properties into a class characterized by a lower figure.

The most important property of hollow ware is the heat resistance. The greater this value is, the better the glass is able to resist sudden changes in temperature. The heat resistance also gives an indication as to the breaking strength. It has been proven that the formula of the heat resistance, developed by Winckelmann is also applicable to breaking strength. The control of a glass batch requires therefore in the first place that it is ascertained into which group the glass belongs with reference to its physical endurance. This can be done by reading diagram 2, which shows into which class belongs the glass indicated by the point. If the result is unfavorable, if the glass belongs in group IV or V with regard to its physical endurance, an attempt must be made to improve the composition. If no other properties are considered, the greatest improvement can be obtained through the smallest change, by drawing a vertical line on the line indicating the class limits, and by changing the composition along this line, until the new glass

comes into the desired classification. For instance if the glass batch is as follows:

Sand	80 lbs.
Soda ash	33.1 lbs.
Limestone	19.7 lbs.

The calculation of the composition gives the following values:

Silica	72.5 Percent
Sodium oxide	17.5 Percent
Calcium oxide	10.0 Percent

As can be ascertained from the diagram this glass belongs to class IV with regard to its physical endurance. A bet-

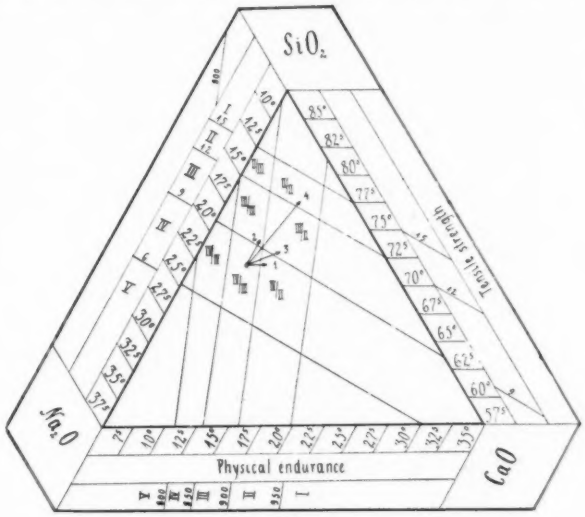

FIG. 3

ter glass would be obtained if the composition were changed in the direction of the arrow. After passing over the limit, point B is reached, having the following composition.

Silica	75.0 Percent
Sodium oxide	15.0 Percent
Calcium oxide	10.0 Percent

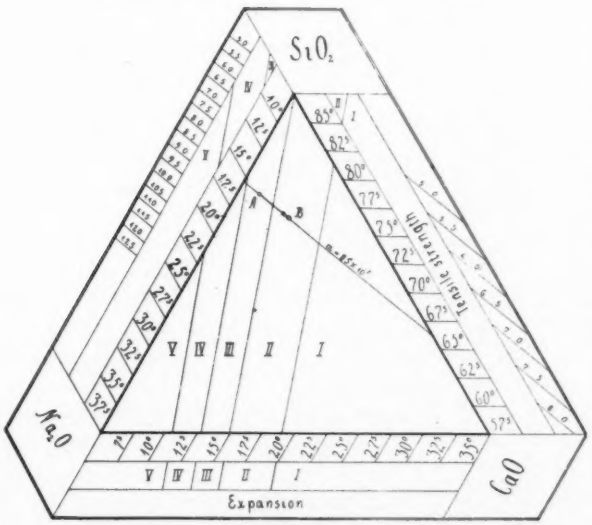

FIG. 4

After calculation of the batch composition from this formula, we obtain the following:

Sand	80 lbs.
Soda ash	27.3 lbs.
Limestone	19.3 lbs.

The glass made from this batch has the physical endurance of class III. If the furnace conditions, the cost and other technical considerations do not prevent it, a further improvement can be effected. If the arrow is followed further a point C is reached, having the composition:

SiO_2	78 Percent
Na_2O	12 Percent
CaO	10 Percent

To obtain this glass, the following batch should be used:

Sand	80 lbs.
Soda ash	21 lbs.
Limestone	18.3 lbs.

As has been demonstrated, this method of improvement leads quickly and correctly to the desired object, namely, to obtain the best possible glass with the smallest possible change in composition. Without this method the changes

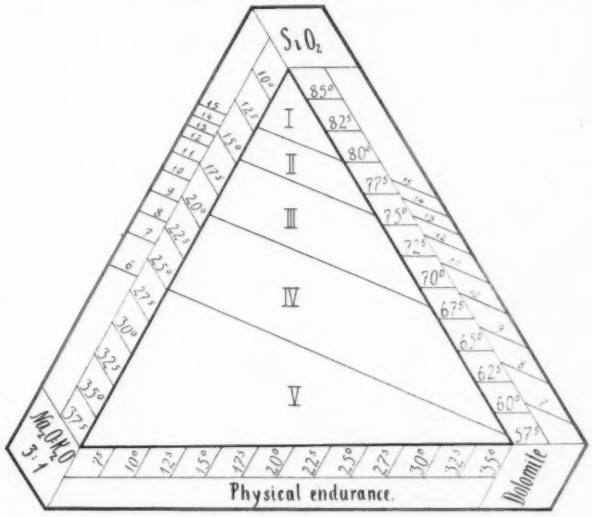

FIG. 5

are made in a haphazard manner and require long and costly experimental melts, which can only have uncertain results. The variation due to changes in three glass-forming oxides in the field of possible glasses is numberless. To obtain the right correction with practical tryouts is a rare coincidence, even if it is known that the way of improvement lies in increasing silica and lime, and decreasing the sodium oxide. The vertical arrow, since it represents a definite figure and a definite direction, shows the shortest possible way to bring glass into any desired classification.

We will now consider the case when not only the physical endurance, but also other properties have to be improved. The physical endurance formula according to Winckelmann:

$$\text{Physical Endurance} = \frac{\text{Tensile Strength}}{\text{Expansion x Elasticity}}$$

$\sqrt{\frac{\text{Heat Conductivity}}{\text{Density x Specific Heat}}}$ is applicable to nearly all other properties which are of importance in the case of hollow ware. However, glass can have a favorable classification as to its physical endurance when other factors are not so favorable. For instance a number of glasses can be compounded having the same physical endurance and different tensile strengths, either better or worse. Suppose a glass is required

which has the best possible physical endurance, and at the same time the best possible tensile strength. To do this we draw in a triangle the limits of the classifications of the physical endurance and the tensile strength. Fig. 3 shows this case. Several fields are formed characterizing these properties. If we indicate these fields with both classification figures, it is observed that a slight change in the direction of arrow I brings the glass into a better class as regards tensile strength. Arrow II brings us to a still better glass. If the furnace conditions do not prevent the melting of a better glass, we can make the changes in the direction of arrow III. Arrow IV leads us to a field in which both properties are in class II, in the field of good glasses.

Furthermore there may be cases in which certain properties must be taken as constant. Such a case is present, for instance, when the coefficient of expansion may not be changed, as in cased glasses, in bulbs and tubing, etc. Improvement then can only take place if, as in graph 4, lines are drawn showing glasses of the same coefficient of expansion and the limits of the classifications with regard to tensile strength. In this manner we obtain a sure indication as to how a glass with a better physical endurance, and with the same coefficient of expansion can be found. Point A, for instance, is moved along the direction of the arrow.

If a glass contains more than three glass-forming oxides there are two possibilities. The first case is present if two glassforming oxides are present in constant proportions, for instance if glass is made with dolomite, or feldspar, or soda and potash in constant proportions. In such a case the triangular graph can be used, the sides of the triangle representing in this case, the properties of the pure glass-forming oxides and also the calculated properties of the glass-forming oxides in constant proportions. Fig. 5 shows a graph constructed with reference to the physical endurance.

It is made of sand, alkalies and dolomite. The latter contains 50 per cent calcium carbonate and 50 per cent magnesium carbonate. The alkalies consist of 25 per cent potash and 75 per cent soda.

Much more complicated is the case when the glass contains more than three glass-forming oxides fully independent as to quantity. The graph, in that case, cannot be drawn in one plane, and to characterize a glass we must draw a tetrahedron, in which the four sides represent the glass-forming oxides. Instead of classes indicated by lines we then have those limited by planes. However, in hollow glass ware this case does not occur frequently.

Besides the properties mentioned above, the chemical resistance must be considered. Unfortunately, however, this property cannot be characterized by means of a triangle, whose sides are the glass-forming oxides. The values representing chemical resistance, however, can be easily calculated by means of arithmetical formulas. These calculations must always be carried out for the control and improvement of glasses, in order to avoid undesirable changes in the chemical resistance.

The numerous researches made in glass cannot be called fruitless, as may be proved from the above method. With the aid of these we can control the composition of glass, and have learned to improve it in a desired direction.

The Storage and Packing of Glassware

G. GEHLHOFF AND R. SCHMIDT[1]

The water film normally existing on a glass surface is not the main agent in the process of weathering. Its action is preparatory. The main agent of decomposition is water which condenses, or falls on the glass surface. Alkali is dissolved out and converted into sodium carbonate by absorption of atmospheric carbon dioxide. Subsequent drying leaves residues of sodium carbonate, which being hydroscopic, form centers of attack, and cause pitting. Alternate heating and cooling increases the speed of weathering process, which is also accelerated by any influence assisting the absorption of moisture from the atmosphere, as wet packing material.

Newly-made lead glass bulbs were covered with a film after only five days' storage in an open space, during moist autumn weather. The film on forty bulbs was washed off by hot distilled water. Calculating on the total weight of glass in the bulbs, the residue after drying the washings at 120 degrees C. was 0.0019 per cent; the loss on ignition at 500 degrees C. of the dried sample was 0.0013, and the non-volatile residue was 0.0006. This non-volatile residue was analyzed and was found to contain SiO_2 21%; K_2O 34%; Na_2O 30%; CO_2 and not determined 15%. No lead oxide was found. The ratio of the soda content to the potash content in the glass was the most favorable, the amounts present being 8% K_2O and 7% Na_2O.

Experiments made with a Thuringian glass of the composition SiO_2 71.4; Al_2O_3 2.9; Na_2O 12.5; K_2O 7.6; and CaO 5.6 gave the following results: the percentages of silica in the matter removed rose from 18.4% after three hours boiling to 36.6% after 12 hours. At the same time, the total alkali in the removed material dropped from 81.6 to 59.3 per cent. Of the total amount removed in 12 hours, 62.3% was removed in the first three hours, whereas only 4.2% was removed in the last three hours. It was found that the suitability of the wrapping paper depended entirely on the degree to which it was hygroscopic. In tests carried out over 1½ years both lead glass bulbs and soda magnesia bulbs were better preserved when stored unwrapped than when stored in the most suitable paper. No difference was noted between the behavior of the two types of glass, the results depending entirely on the kind of paper used. The quality of the papers did not depend on the amounts of resinous size, ligneous fibre, aluminum sulphate or sodium sulphate in the paper. Some of the papers caused bulbs to film in less than three months. The effects of carton packing were similar to those of paper wrapping, but to a less degree. No articles should be stored in paper for more than a year. Storage rooms should be dry, well ventilated and preferably be heated in winter. Well-annealed glass resists attack much better than strained glass. Some evidence was obtained to support the theory that the "blueing" of lead glass, stored under moist conditions was due to reduction of lead compounds. Mechanically polished surfaces are less durable than fire polished surfaces. The poor durability of the internal surfaces of hollow ware, compared with the outer surfaces is not due to differences in the chemical composition resulting from fire polishing, nor to chilling.

[1]Abstract of article in *Sprechsaal*, Vol. 60, pp. 336, 352.

Preliminary Statement on Window Glass Costs Made Public by Tariff Commission

Washington Public Hearing Again Postponed—Until September Eleventh

THE opening of the United States Tariff Commission's long expected public hearing on the costs of production of window glass in this country and Belgium which was announced on July 2 to take place August 7, has been postponed twice by request of the Belgian interests and is now set for September 11, 1928. The first meeting will begin at 10 a. m. that day in the Commission's offices, Old Land Office Building, 8th and E streets, Washington, D. C.

There has also been issued through John F. Bethune, Secretary of the Commission, a Preliminary Statement ot Information obtained by representatives of the Commission in the pending investigation, as ascertained pursuant to the provisions of Section 315, Title III, of the Tariff Act of 1922. This statement consists of 92 pages of data on the production and marketing of window glass and contains a five page index of contents, many statistical tables, appendices A and B, and maps.

This investigation, No. 68, was ordered by the Tariff Commission on May 26, 1927, for the purpose of determining the differences in cost of production of "cylinder, crown, and sheet glass, by whatever process made, and for whatever purpose used, unpolished," wholly or in part the growth or product of the United States, and of like or similar articles wholly or in part the growth or product of competing foreign countries.

History of the Investigation

An application requesting an investigation for an increase in the duty on window glass, was filed with the commission April 7, 1927, by James B. Reynolds, for the American window glass manufacturers.

The Commission as stated above instituted the investigation, May 26, 1927. During July, August, and September representatives of the Tariff Commission (four accountants and one commodity expert) obtained domestic cost data for the year 1926 from 25 plants, producing approximately 92% of the total window glass manufactured in the United States. During the winter 1927-1928, the same commodity expert and one of the four accountants employed in the domestic work, obtained cost data for the year 1926 from 13 Belgian plants, the output of which amounted to about 50% of the total Belgian production for 1926, exclusive of that produced by the Libbey-Owens plant in Belgium. Cost data for this plant were not obtained as its product is not exported to the United States.

Information Obtained in Commission's Investigation

Window glass is made in several different qualities and in varying thicknesses. Single strength glass, representing approximately 70% of the total domestic production, measures 12 sheets to the inch and weighs approximately 18½ ounces per square foot. Double strength glass, representing over 7% of the total domestic production, measures nine sheets to the inch and weighs approximately 24½ ounces per square foot. Window glass is produced in small quantity in thicknesses heavier than double strength, and this extra heavy glass according to its thickness is classified as 26-ounce glass, 29-ounce glass, 34-ounce glass, and 39-ounce or 3/16 inch, glass. This heavier glass, some of which is known in the trade as crystal sheet glass and as vitrea crystal glass, possesses a brilliant surface and more uniform thickness than other kinds. With respect to the quality of window glass several grades are recognized; the two which are the ordinary standard grades are known and marketed as A quality and B quality. A grade of window glass, known as AA quality, is sold for special purposes in limited quantity. It has an even surface, is well flattened, and is free from any perceptible defects, such as air bubbles, blown specks, cords and strings. The entire output of this particular grade of glass does not exceed three per cent of the total window glass produced. There is also a limited domestic production of fourth and C qualities, which are inferior to the B quality and other standard grades. First and second qualities of window glass, very little of which is imported, compares with AA and A qualities produced in the United States. The third and fourth qualities of the imported Belgian window glass are comparable with the B and fourth qualities produced in the United States.

Present Rates of Duty

Cylinder, crown, and sheet glass (common window glass) unpolished	Act of 1922 (Par. 219)	Act of 1913 (Par. 85)	Act of 1909 (Par. 99)
	Cents per pound		
Not exceeding 150 square inches.....	1¼	⅞	....
Valued not more than 1½ cents per lb.	...	....	1¼
" " " " " "	...	....	1⅜
Above 150, and not exceeding 384 sq. in.	1⅜	1	....
Valued not more than 1¾ cents per lb.	...	....	1¾
" " " " " "	...	....	1⅞
Above 384 and not exceeding 720 sq. in.	1⅝	1⅛	....
Valued not more than 2⅛ cents per lb.	...	....	2¼
" " " " " "	...	....	2⅜
Above 720 and not exceeding 864 sq. in...	1¾	1½	2¾
" 864 " " " 1,200 " "	2	1½	3¼
" 1,200 " " " 2,400 " "	2¼	1⅞	3¾
" 2,400.....	2½	2	4¼

Provided, That cylinder, crown, and sheet glass (common window glass) unpolished, imported in boxes, shall contain fifty square feet, as nearly as sizes will permit, and the duty shall be computed thereon according to actual weight of glass.

Processes of Manufacture

Common window glass is made by various processes in this country and abroad. Cylinder glass is produced by both hand and machine-blown processes. Window glass known as sheet glass is produced by drawing, as contrasted with blowing processes. The crown method, a hand-blown operation, is in disuse at the present time.

Brief descriptions of the hand-blown cylinder process, machine-blown cylinder process, the sheet glass drawing process, including the Libbey-Owens and the Fourcault processes are given in the Preliminary Statement. These processes have all been fully described and illustrated in THE GLASS INDUSTRY during the past few years.

The Window Glass Industry of the United States

In 1926 there were 24 window glass companies in the United States, operating 32 plants located as follows:

West Virginia	10	California	2
Pennsylvania	7	Arkansas	1
Ohio	3	Louisiana	1
Indiana	2	Texas	1
Kansas	2	Wyoming	1
Oklahoma	2		

West Virginia ranked first in production, Pennsylvania second, Indiana third, and Louisiana fourth. Twelve companies, using the cylinder machine process produced in 1926 in 19 plants, 59% of the total domestic production; three companies using the Libbey-Owens process, produced in three plants, 29% of the total; five companies, using the Fourcault process in five plants, produced 8%; and three companies using the hand-cylinder process and one company using their own patented drawing process, produced collectively the remaining 4%.

Production of window glass in the United States for 1926 by processes and by thicknesses is shown in the accompanying Table 2.

Table 2

Window glass: 1926. Production by processes and thicknesses in the United States[1].

Process	Single Strength		Double Strength		Triple Strength		Total	
	Amount	Per cent of total	Amount	Per cent of total	Amount	Per cent of total	Amount	Per cent of total
	Square feet		Square feet		Square feet		Square feet	
Machine cylinder	232,772,000	75	73,670,950	23	7,414,750	2	313,857,700	100
Libbey-Owens	94,099,350	62	49,787,250	33	8,025,450	5	151,912,050	100
Fourcault	30,116,900	70	12,283,700	29	403,950	1	42,804,550	100
Hand cylinder	8,285,600	79	2,176,000	20.8	18,700	.2	10,480,500	100
Other processes	6,960,300	64	3,984,900	36		-	10,945,200	100
By all processes.	372,234,350	70	141,902,800	27	15,862,850	3	530,000,000	100

[1] Source: Records of domestic manufacturers.

The Window Glass Industry of Europe

Window glass is produced in Europe by three processes, hand-blown cylinder, Libbey-Owens, and Fourcault.

The hand-blown cylinder process, which until shortly before the war was the only process used in Europe, is rapidly being replaced by the more modern mechanical methods introduced by Libbey-Owens and Fourcault. Owing to the comparative cheapness of labor in the window glass industry of Europe, the mechanization of plants, however, has been, until recently, slower than in America, and hand-blown glass is still produced in considerable quantities. The present tendency towards mechanical production is indicated by the number of Libbey-Owens and Fourcault machines in factories of the principal European window glass producing countries since the signing of the armistice. A list of these countries and the number of machines installed follows:

Country	Number of Machines: Fourcault	Libbey-Owens
Belgium	146	12
France	40	6
Czechoslovakia	40	..
Russia	50	..
Germany	30	4
England	14	..
Holland	10	..
Poland	8	..
Italy	6	4
Spain	6	1
Greece	6	..
Switzerland	..	1
Total	356	28

The potential producing capacity of these machines is approximately one and one-half billion square feet of single strength glass annually. The existing total European production by all methods, as estimated authoritatively for 1926, is 1,180,000,000 square feet, of which over one-half is produced by the Libbey-Owens and Fourcault processes. The estimated production of the various countries is as follows:

Estimated production of window glass in European countries, 1926:

Country	Production (Square Feet)
Belgium	550,000,000
Germany	180,000,000
France	125,000,000
Czechoslovakia	110,000,000
Italy	100,000,000
England	80,000,000
Spain	25,000,000
Switzerland	10,000,000
Total	1,180,000,000

The Window Glass Industry of Belgium

Twenty-eight of the thirty-three plants operating in Belgium (1927) are concentrated in a comparatively small area, including Charleroi, Dampremy, Jumet, Courcelles, Cronfestu, Haine St. Pierre, Binche, Bonne Esperance,

(*Continued on second page following*)

The Machine-Blown Cylinder Process

IN the machine-blown cylinder process, the machine accomplishes the same immediate results as those obtained by the individual glass blower. The molten glass in a large tank is ladled from the refining end of the tank into a series of pots, each holding enough glass to make a cylinder of the desired size and thickness and maintained at a temperature sufficiently high to keep the glass in a semi-plastic state. A separate machine is operated for each of these pots into which is lowered a pipe or tube, having at its extremity a mushroom-shaped cap to which the glass quickly adheres. The tube is then slowly raised while compressed air controlled by the operator is blown through it to the inside of the hollow globe of glass which is attached both to the glass in the pot and to the cap of the tube of the machine. This globe appears to stretch into an increasingly elongated cylinder as the tube of the machine continues to rise and more and more air is admitted.

At length when the cylinder has reached a height of approximately 50 feet, the motion of the machine is stopped and the cylinder, broken loose from the cap and from the pot, is lowered by mechanical means to a rack which receives it. Here it is cut into sections and each section split lengthwise by means of red-hot wires, and from the cutting rack the sections are transferred to flattening ovens in which the proper temperature softens the glass. In these ovens the cylindrical-shaped sheets assume a semi-flattened shape under the wilting effects of the heat, and are further flattened by means of wooden hoes thrust into the oven and used with an ironing motion. Next the sheets of glass pass through an annealing oven, after which they are ready for inspection, are cut into the exact sizes desired, and packed in boxes.

The hand-blown cylinder process came into general use in the United States and elsewhere in the early part of the nineteenth century and was the principal method until 1903. The first step in this process is to gather enough molten glass from the fining compartment of the melting tank on the end of a hollow pipe to form a small ball. The gatherer slightly elongates this ball by blowing through the pipe, then inserts it back into the tank and gathers more glass by rotating the pipe in the molten mass until sufficient glass adheres to produce when blown a cylinder of the desired size. The globular mass thus formed is about the size of a man's head and weighs from 40 to 50 pounds. Next the workman elongates the ball of glass still further by blowing through the pipe, at the same time swinging it to and fro in a pit or opening in the floor near the furnace.

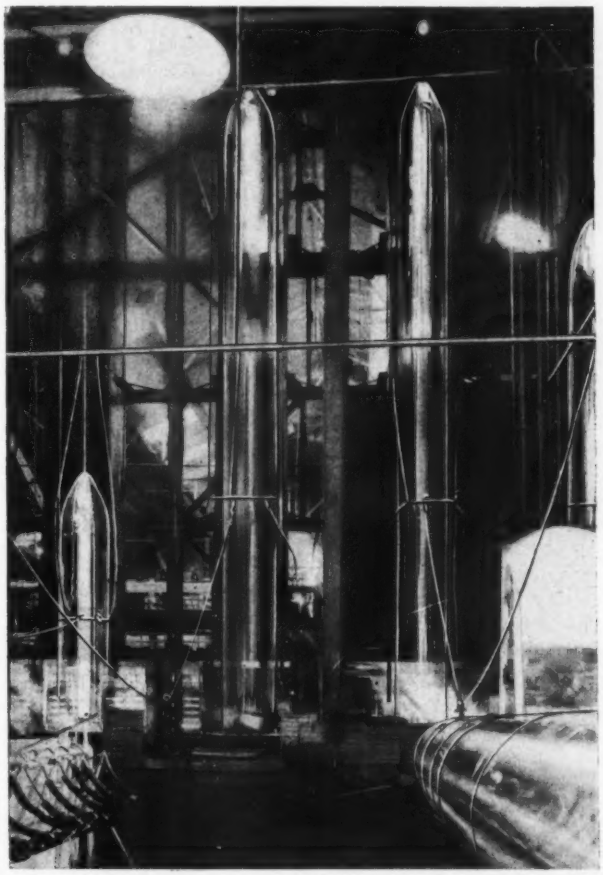

FIG. 1. A BATTERY OF GLASS CYLINDER BLOWING MACHINES AT WORK.

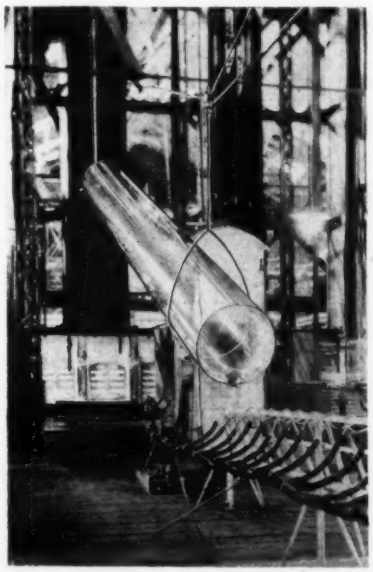

FIG. 3. LOWERING A CYLINDER TO A RACK.

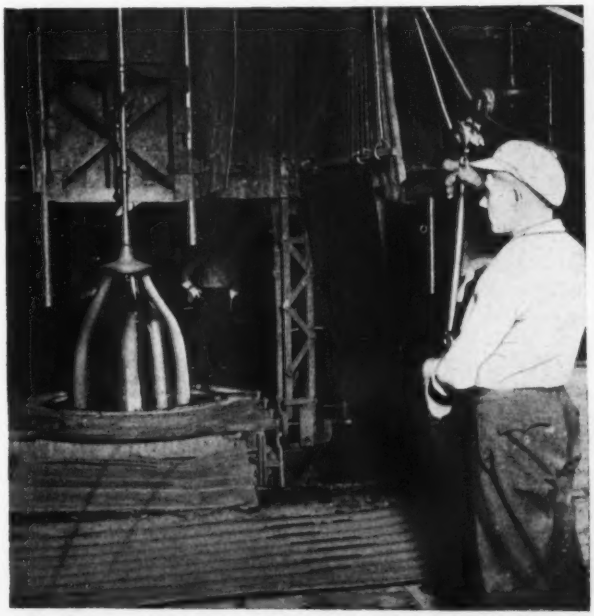

FIG. 2. BEGINNING THE BLOWING OF A CYLINDER.

Lodelinsart, Gilly. In the districts adjacent to these towns there are ten Fourcault machine plants. There are also Fourcault plants at Jemappes, Zeebrugge, Merxem, Lommel, and a Libbey-Owens plant at Moll. In 1912 there were 24 plants in existence of which only 18 were in operation. At that time Belgian production had decreased, being entirely dependent on the hand-blown cylinder process. During the war the industry was inactive but by 1924 production was back to pre-war level and in 1926 was even 24% above the figure for 1913. This advance was due largely to the introduction since 1922 of mechanical processes of production. This substitution has made great strides during the past six or seven years causing revolutionary changes in the industry. Before the war only one factory, a Fourcault plant, produced window glass by mechanical means. This plant began production in 1913 and it was not until August, 1922, that the second Fourcault plant was built. Up to July, 1927, ninety Fourcault machines were installed in eleven old and new factories.

The Preliminary Statement shows the Belgian output of window glass for a number of years for all plants except two not members of the Association Des Verreries Belges. The total amount produced in the year 1927 is given as 566,368,000 square feet including total mouth-blown production, 167,277,000 square feet, and the mechanically made production 399,091,000 square feet equivalent to 7,981,820 boxes of 50 square feet. Included in these figures is the output of the mechanical plant of the Libbey-Owens company which was put into operation in 1923.

The total Belgian production before the war (1913) was approximately 460,000,000 square feet, the equivalent of nine million 50 foot boxes. At that time the production of Fourcault glass amounted to only 13,674,000 square feet. In 1927 the production of mouth-blown glass had fallen to 167,000,000 square feet; the production of Fourcault glass was then 280,301,000 square feet. Thus of the total production of window glass in Belgium for 1927, 566,368,000 square feet, approximately 30% was produced by mouth-blowing and 70% by mechanical means. Among the causes of the transition from hand to mechanical methods, the most important was the scarcity of labor after the war.

The revolution in the Belgian window glass industry is still in progress and will probably not be completed until all of the factories have been mechanized. The production of mouth-blown glass is now confined very largely to photo glass. Preparations are now (1928) being made for the tansformation of several of them by the installation of Fourcault machines.

Organization of the Comptoir Fourcault

The rapid installation of new Fourcault machines, especially after November, 1924, as well as the increasing output of the new Libbey-Owens plant, caused a significant increase in the total production of Belgian window glass. As long as the Belgian currency continued to depreciate little difficulty was found in marketing the glass abroad, but after the stabilization of October, 1926, the artificial stimulus to exports was removed. Exports of Belgian window glass in 1926 were greater than 1925 but the increase was much less than the increase in production. While exports gained 8.6%, output increased 24%. Export prices which had shown a falling tendency (measured both in paper and in gold) up to the middle of 1926 stiffened when it was apparent that stabilization was imminent and tended to rise during the latter months of the year. But after stabilization, costs rose more rapidly than prices. This was the situation which led in June, 1927, to the formation of a central sales bureau of certain Belgian window glass companies, known as the Comptoir Fourcault.

The Comptoir, whose official title is "Comptoir General pour la Vente des Verres Fourcault," is a limited liability company. Its capital is owned by ten factories producing window glass by the Fourcault process. The production of the members of the Comptoir in 1926-1927 was 3,540,418 boxes.

The new plant went into operation January 1, 1928, and ten companies which are members are now selling their Fourcault window glass through the central sales office. All of the trade marks formerly used by the individual factories have been abolished and the single trade mark of the Comptoir has been substituted.

This plan of centralized control of exported glass puts the matter of price, in dealings with outside customers, beyond the influence of the producing companies who participate in the arrangement. In forming the "Comptoir Fourcault" the objects were: (1) To establish more uniform prices at which exported Belgian glass is sold; (2) to avoid price cutting and other forms of harmful competition among the companies affiliated; (3) to adjust production in accordance with the demand; (4) to effect economies in selling expense; (5) to act as a clearing house for information, affording a better understanding of conditions in the industry; and (6) to assure the maintenance of standards with respect to quality. The activities of the "Comptoir Fourcault" are similar to those of the "Union" selling organization which handles exports for the Belgian plate glass industry.

This organization buys the glass from each of the affiliated companies at a prearranged nominal price, thereby acquiring title and control, and sells it at the best price obtainable in the markets of the world. The difference between the selling price and the nominal purchase price with respect to the glass of any particular producer, is, after deduction of selling expenses, paid to that producer.

Prior to 1928 all exported Belgian window glass was sold through dealers located in Belgium, who purchased from producers at basic prices which varied with the quality, strength, and size of the glass, and were subject to discounts according to the amounts purchased. These dealers sold to importers and jobbers throughout the world, at the basic prices quoted by the producers plus a commission, which usually amounted to 5%.

Patents and Royalties

The patent rights for the Fourcault process are owned by the Societe Anonyme des Brevets Fourcault, founded in 1905, which issues licenses and installs the machines. The royalty is collected on the basis of glass packed. The Fourcault patents expired in 1927 in all countries except Belgium

(Continued on second page following)

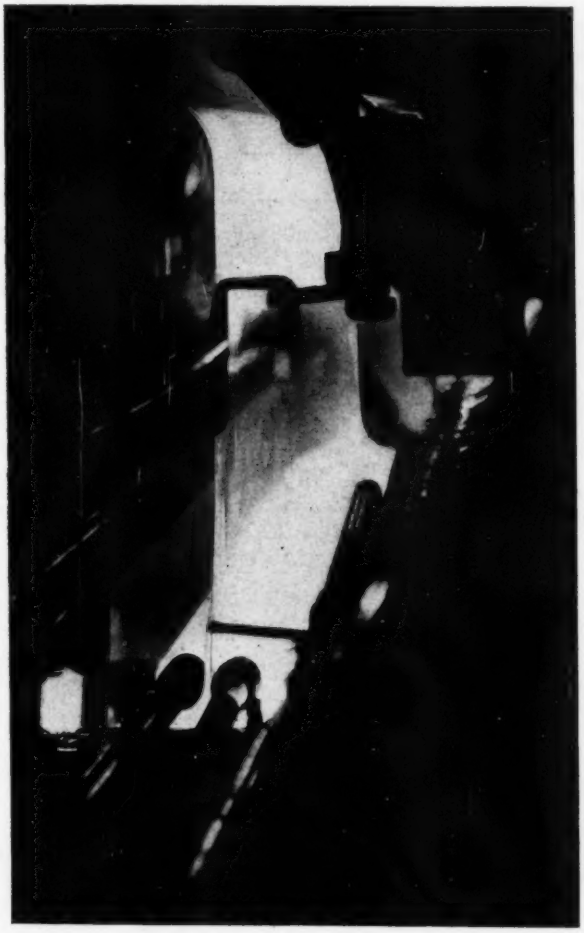

FIG. 1. DRAWING A CONTINUOUS SHEET OF GLASS FROM THE MOLTEN MASS IN THE FURNACE.

The Libbey-Owens Process

IN the Libbey-Owens process, drawing of the sheets is accomplished by first placing the machine in reverse motion, which allows a bait made of iron and about 3 inches wide and 6 feet long to be introduced into the molten mass of glass. The machine is then placed in forward motion and the plastic glass adhering to the bait is pulled or drawn upward about 2 or 3 feet, after which the direction changes to a horizontal one which carries the drawn sheet of glass over a flattening table and then into an annealing oven. As the strip of glass, from 6 to 8 feet wide, emerges from the cold end of the oven, it is cut into large sheets which are afterwards cut again into small sheets of commercial sizes. The thickness of the glass mechanically produced by this process depends upon the rate of speed of the drawing operation and upon the temperature of the glass. If the sheet is drawn at a speed of from 40 to 60 inches per minute, the usual window glass thicknesses (single and double strength) are obtained. To secure a thickness of ¼ of an inch, the machine is made to operate at approximately 23 inches per minute. It is possible to produce with the Libbey-Owens machine different thicknesses up to 7/16 of an inch. Operated at the higher rates of speed the machine will turn out 30,000 square feet of single strength glass in 24 hours, equivalent to 1,250 square feet per hour. This may be compared with 160 square feet per hour produced by an individual hand blower, and about 750 square feet per hour produced by the machine-blown cylinder process.

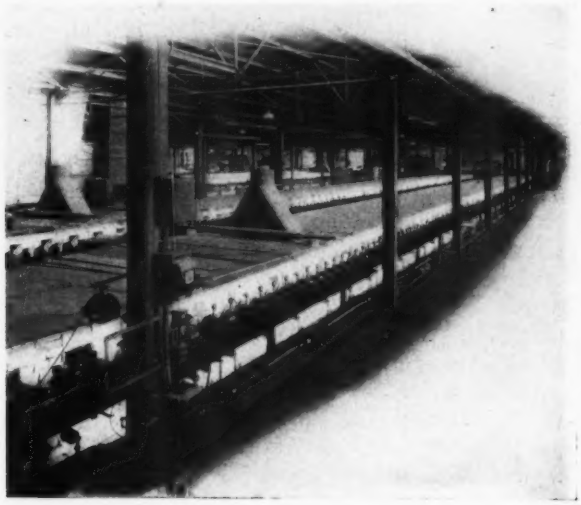

FIG. 2. THE LONG LEHR THROUGH WHICH THE CONTINUOUSLY MOVING SHEET OF GLASS PASSES WHILE BEING ANNEALED.

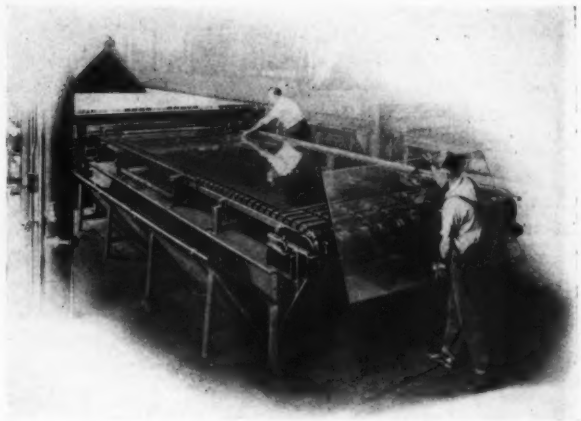

FIG. 3. CUTTING AND REMOVING THE SHEET AT THE OUTER END OF THE LEHR. THIS IS THE ONLY HAND OPERATION IN THE ENTIRE PROCESS.

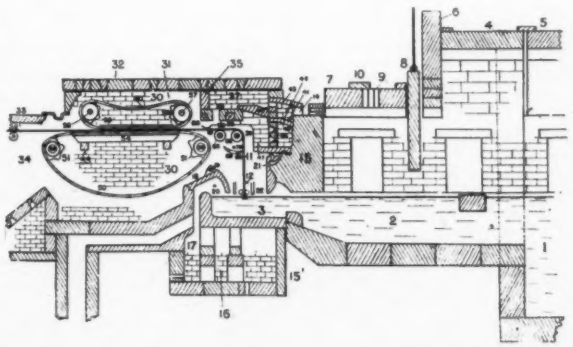

FIG. 4. DIAGRAM SHOWING (AT 12) HOW THE MOLTEN GLASS IS DRAWN FROM THE TANK, TURNED OVER THE ROLLER AND ENTERED INTO THE ANNEALING LEHR.

where they will expire in 1931. In all licenses granted the Belgian countries for the manufacture of Fourcault glass there is an important restriction which limits the thickness of the glass thus produced to 4 m/m. or less. This is included for the protection of the plate glass manufacturers.

Exports of Window Glass from Belgium

The Preliminary Statement gives the exports from Belgium to principal countries for various years. The total amount of exports in the last year reported, 1926, was 254,316 metric tons. Great Britain took 49,893 tons or 19.6% of the total, the Netherlands 35,919 tons, equal to 14.1%, United States 29,036 tons, 11.4%, Canada 20,638 tons, 8.1%, British India 10,746 tons, 4.2%, Argentina 10,722 tons, 4.2%, Denmark 10,013 tons, 4%, Australia 10,013 tons, 4%, China 8,101 tons, 3.2%, Brazil 6,323 tons, 2.5%, Japan 5,177 tons, 2%. All other countries 57,735 tons, 22.7%.

The United States as a market for Belgian window glass in 1926 compared with 1922 appears to have declined from the second position. It was second in 1923, constituting that year the market for 12.5% of the Belgian exports.

United States Imports of Window Glass

For a number of years prior to the world war imports of window glass into the United States ranged from 20,000,000 to 30,000,000 pounds per year. During the war imports were insignificant but with the resumption of European production in 1919-1920 imports of glass increased to 52,000,000 pounds in 1922. An increase of 67% the first year following the depression of 1920-1921 compared with the last year before the war was due to the fact that American producers were not prepared to meet the demands of the building boom which began in 1922. The American producers during the next two years more than caught up with the domestic demand and imports in 1924 fell to less than 31,000,000 pounds. This figure is almost identical with the quantity imported for the fiscal year 1913-1914. Since production in Europe, especially in Belgium, by machine process commenced in 1924, total imports into the United States of window glass increased 48% in the following year and in 1926 they increased 77% over the preceding year, reaching a total of 80,884,601 pounds, with a value of $3,129,075. These imports approximated 11% of the total domestic production.

United States imports are mainly single strength, third quality glass, and in sizes within the first three tariff classifications; that is, less than 720 square inches. Distribution of imports of window glass by tariff classifications or groups of sizes is shown in the Preliminary Statement for 1924, 1925, and 1926. Imports under the three smaller brackets predominate.

Belgium is now and has been for many years the principal country of origin of United States imports of window glass. Prior to the world war, 85% of total imports came from Belgium and most of the remainder from England. Since the war Czechoslovakia has become an important window-glass producing country and a factor in competitive trade. United States imports from that country have steadily increased in recent years, and in 1926 represented 22% (in quantity) of the total imports. A comparison of relative values indicates that imports from Czechoslovakia probably consist largely of glass heavier than single and double strength. The heavy drawn window glass, known to come from Czechoslovakia under the trade name of Vitrea, is similar to the heavy drawn sheet glass made in the United States by the Libbey-Owens and Fourcault processes and to the crystal sheet made in this country by the machine-cylinder process.

While imports of glass from Belgium are proportionately somewhat less in recent years they are still greater than the imports from all other countries combined and in absolute amount are substantially increasing. These imports, moreover, consist predominatingly (as established by an analysis of invoices covering one-fourth of the whole in 1926) of the smaller sizes, of the single and double thicknesses, and of the third quality,—which varieties of glass are directly comparable with the bulk of the domestic production.

The general imports of window glass into the United States by countries for the years 1924-1927 are given in the Preliminary Statement. The total quantity in 1924 was 30,799,664 lbs. value $1,768,793; in 1925 the qauntity was 45,585,770 lbs. and the value $2,395,168; in 1926 the quantity was 80,902,020 lbs., value, $3,130,922. The total for 1927 was 82,747,510 lbs., total value $2,861,771. 77.91% of the total by quantity and 59.89% by value of the total came from Belgium. 16.81% by quantity and 30.26% by value came from Czechoslovakia. 2.67% by quantity and 3.70% by value came from Germany. .75% by quantity and 4.19% by value came from the United Kingdom. 1.86% by quantity and 1.96% by value came from other countries.

A stoppage of production in Europe during the war put the United States temporarily in the position of the principal source of supply for the world market. Exports in 1919 had increased to 13% of the domestic production in contrast to five-tenths of 1% in 1923 and three-tenths of 1% in 1926. Before the world war exports of window glass from the United States were inconsiderable.

Domestic Consumption

In 1926 the country consumed 595,951,200 square feet of window glass. Domestic manufacturers produced 530,000,000 square feet (from records of manufacturers), exported 1,548,800 square feet, and 67,500,000 feet were imported. The ratio of imports to domestic consumption was 11.3%

The wholesale price on single strength A quality is shown to have been in 1913, $1.60 per box containing 50 square feet. In 1927 it was $2.28. Based on the price of glass in 1913 as 100, the 1927 index is 142.5. Single strength B quality in 1913 was 1.52; in 1927, 1.94; index number 127.6. The wholesale price of double strength A quality in 1913 was $2.17, in 1927 $3.45, index number 159.0. B quality 1913, $2.05, 1927 $2.96, index number 144.4.

The Preliminary Statement gives with respect to all sizes the domestic wholesale prices (f.o.b. plant) in effect during 1926, for the leading thickness (strengths) and qualities. Over 70% of domestic sales are of single strength and B

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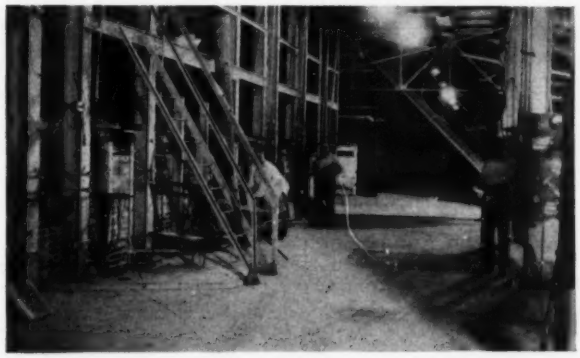

FIG. 1. A BATTERY OF FOURCAULT MELTING FURNACES AND DRAWING MACHINES AT FLOOR LEVEL

The Fourcault Process

BY the Fourcault method a slotted block of refractory material having less density than glass is placed in the drawing tank of molten glass. When pressure is applied to this block, which would otherwise float, the molten glass flows upward through the slot, from the peculiarly-shaped lips of which it is continuously removed by the drawing apparatus. This consists in a series of asbestos-covered steel rollers, placed in pairs directly above the drawing block. These steel rollers lift or pull the glass by friction, being in contact with the glass across the entire width of the sheet. The whole series of rollers, with the exception of the four upper pairs, are inclosed in a box-like structure of steel plates. This box-like structure retains the heat and thus serves as an annealing lehr (tempering oven). While the ascending sheet of glass is being drawn it cools slowly and uniformly (or is annealed) and emerges from the top of the machine in condition for immediate cutting.

The thickness of the finished sheets is determined by the temperature of the molten glass and by the speed of the lifting rollers. As in the Libbey-Owens process, the faster the rollers revolve, the thinner will be the sheet of drawn glass. To obtain sheets of glass thicker than those ordinarily desired, the machine is operated at less than its maximum rate of speed. The maximum rate of speed, available for single strength glass, will turn out approximately 550 square feet per hour.

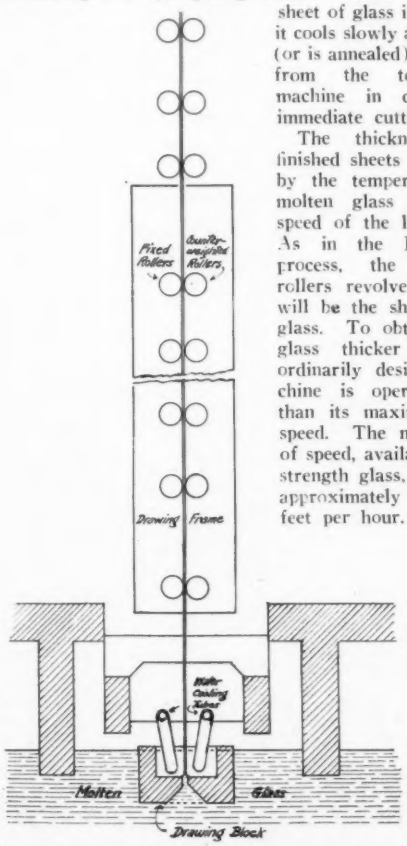

FIG. 2. SHOWING ESSENTIAL FEATURES OF FOURCAULT SHEET GLASS DRAWING MACHINE.

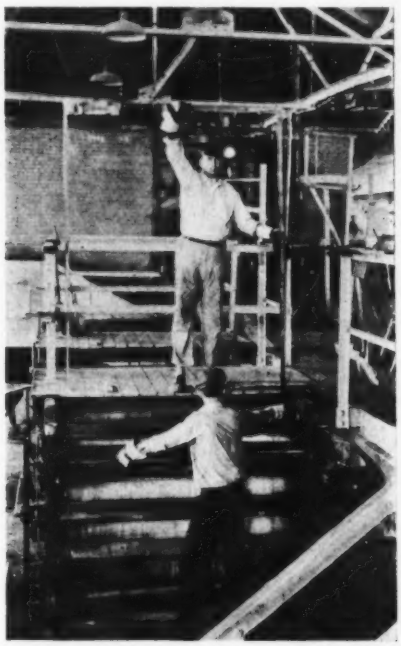

FIG. 3. THE CONTINUOUS SHEET OF GLASS IS CARRIED BETWEEN ROLLERS TO THE TOP OF THE MACHINE WHERE IT IS CUT TO SIZE FOR CONVENIENT HANDLING.

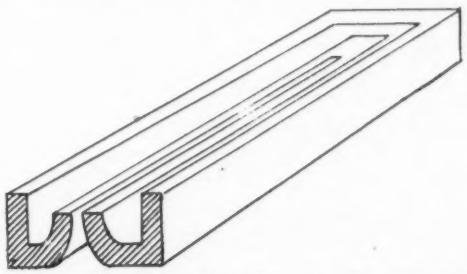

FIG. 4. THE DRAWING BLOCK OR "DEBITEUSE."

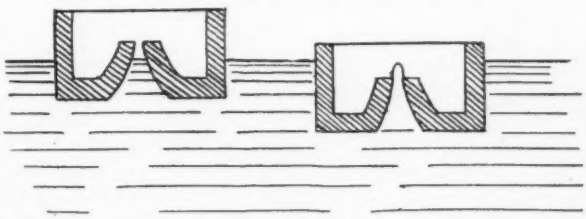

FIG. 5. SHOWING THE PRINCIPLE, AS DESCRIBED, ON WHICH THE FOURCAULT PROCESS IS BASED.

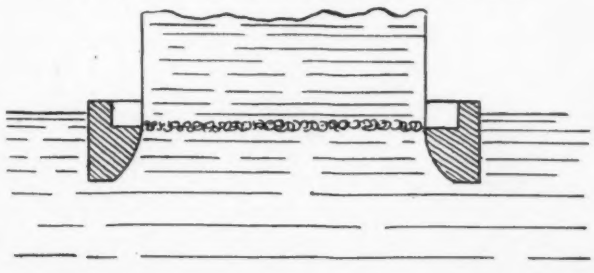

FIG. 6. SECTIONAL VIEW SHOWING SHEET OF GLASS PASSING UPWARD THROUGH SLOTTED BLOCK.

Table A

Window Glass: United States. 1916. Cost of production by plants, grouped according to process of manufacture, with the weighted average cost for each group of plants and for all plants combined, per box containing 50 square feet as single strength thickness.

Plant No.	Cost Items										
	Direct labor	Power and heat	Raw materials	Manufacturing materials and supplies	Repairs and maintenance	General plant overhead	General office overhead	Total	Imputed interest	Total with imputed interest	Selling expense
	Dollars per box										
Sheet drawing process plants [1]											
1	$0.516	$0.324	$0.377	$0.226	$0.173	$0.392	$0.099	$2.107	$0.197	$2.304	$0.030
2	.457	.215	.443	.237	.132	.696	.044	2.224	.158	2.382	.041
3	.572	.687	.327	.248	.165	.313	.094	2.406	.074	2.480	.030
4	.747	.174	.397	.238	.125	.277	.103	2.061	.236	2.297	.071
5	.836	.232	.378	.283	.034	.166	.034	1.963	.065	2.028	.038
6	.645	.253	.391	.231	.087	.395	.102	2.104	.195	2.299	.074
7	1.265	.529	.880	.427	.143	.763	.183	4.190	1.080	5.270	.166
Weighted average sheet drawing process plants	.548	.300	.399	.235	.147	.450	.083	2.162	.187	2.349	.040
Cylinder process plants [2]											
8	.935	.352	.298	.266	.090	.410	.077	2.428	.169	2.597	.070
9	.949	.379	.296	.271	.101	.352	.077	2.425	.205	2.630	.055
10	.899	.444	.278	.257	.075	.344	.072	2.369	.096	2.465	.053
11	.964	.170	.285	.320	.062	.412	.084	2.297	.080	2.377	.080
12	1.056	.449	.305	.320	.077	.423	.084	2.714	.897	3.611	.113
13	.963	.254	.306	.298	.065	.229	.087	2.202	.019	2.221	.053
14	1.021	.238	.345	.218	.024	.176	.128	2.150	.033	2.183	.058
15	.888	.391	.357	.250	.027	.255	.050	2.218	.085	2.303	.042
16	.937	.305	.319	.370	.033	.217	.043	2.224	.031	2.255	.032
17	.851	.493	.373	.195	.010	.306	.045	2.273	.151	2.424	.090
18	.866	.524	.323	.279	.264	.681	.051	2.988	.217	3.205	.048
19	.817	.427	.317	.297	.263	.520	.049	2.690	.086	2.776	.048
20	.938	.603	.388	.235	.278	.705	.054	3.201	.245	3.446	.045
21	.854	.308	.361	.245	.288	.717	.047	2.820	.230	3.050	.048
22	1.157	.549	.359	.221	.152	.151	.038	2.627	.055	2.682	.097
23	.956	.284	.316	.238	.125	.198	.059	2.176	.056	2.232	.070
24	1.079	.540	.254	.275	.041	.091	.076	2.356	.010	2.366	.068
25	1.297	.502	.262	.273	.070	.371	.030	2.805	.041	2.846	.071
Weighted average cylinder process plants	.936	.374	.312	.267	.113	.372	.070	2.444	.135	2.579	.059
Weighted average, all plants	.784	.346	.345	.255	.126	.402	.075	2.333	.155	2.488	.052

[1] Includes 4 plants operated by the Fourcault sheet drawing process and 3 plants operated by the Libbey-Owens sheet drawing process.
[2] Includes 16 plants operated by the machine cylinder process and 2 plants operated by the hand-cylinder process. The inclusion of costs for the two hand-cylinder plants has but a slight effect upon the average for the cylinder process group.

quality, and in sizes less than 720 square inches or 60 unit inches.

Belgian window glass was sold prior to 1928 in wholesale quantities to importers and jobbers in the United States through dealers located exclusively in Belgium, whose prices varied with the size, thickness, and quality of the glass, and also with the amount of the order, the factory from which purchased, and with the particular market to which the glass was consigned. Since the formation in 1927 of the "Comptoir Fourcault" a large part of the window glass produced in Belgium by the Fourcault process has been sold by this centralized selling organization rather than by independent dealers. These independent dealers, however, continue to sell for export the Belgian glass produced in the hand-blown factories, a declining but still considerable proportion of the total exports.

The Preliminary Statement gives wholesale prices f.o.b. Antwerp, 1926, for Belgian exports to the United States in single and double strength A and B qualities. Similar data appears for double strength and B (third) quality (1926).

A comparison for the year 1926 of Belgian export prices with United States prices for a considerable range of sizes in single strength and B quality is given. There is also shown with respect to each size of the imported Belgian glass of this strength and quality, the existing specific duty and the equivalent ad valorem rate of duty calculated from the price (value) of the Belgian glass.

Elements of Cost: United States

The cost data obtained by the commission's agents through field work conducted during 1927, are for the year 1926 and cover approximately 92% of the total domestic production for that year. They apply to plants new and old, operating under varying conditions of operation, in all sections of the country where window glass was being produced in 1926. Out of 32 plants then operating, 25 were studied and the costs obtained usually for a full year (calendar or fiscal), but in some instances for an operating period less than a full year.

The cost of production in cents per pound by United States plants is shown by groups according to processes of manufacture. The weighted average costs for each group and for all plants combined are given. The costs for two hand-cylinder process plants are included under the cylinder process group. Of the total production for all plants investigated 34.04% was produced by the 3 plants using the Libbey-Owens sheet drawing process, 7.15% by the 4 plants using the Fourcault sheet drawing process, 57.73% by the 16 plants using the machine-cylinder process and 1.08% by the two plants using the hand-cylinder process.

Table D

Window Glass: United States. 1926. Cost of production by departments for plants grouped according to process of manufacture, with the weighted average for each group of plants and for all plants combined, per box containing 50 square feet as single strength thickness.

Plant No.	Departments						Total	Imputed interest	Total with interest	Selling expense
	Mixing	Melting, drawing, or blowing and annealing	Cutting	Packing	Ware-house	Shipping				
	- - - Dollars per box - - -									
Sheet drawing process plants [1]										
1	$0.425	$0.915	$0.349	$0.352	$0.032	$0.034	$2.107	$0.197	$2.304	$0.030
2	.489	1.025	.320	.336	.034	.020	2.224	.158	2.382	.041
3	.350	1.391	.310	.311	.025	.019	2.406	.074	2.480	.030
4	.437	.888	.346	.344	.022	.024	2.061	.236	2.297	.071
5	.400	.978	.264	.280	.029	.012	1.963	.065	2.028	.038
6	.437	.911	.408	.305	.024	.019	2.104	.195	2.299	.074
7	.939	2.153	.414	.517	.083	.084	4.190	1.080	5.270	.166
Weighted average sheet drawing process plants.	.443	.977	.341	.341	.032	.028	2.162	.187	2.349	.040
Cylinder process plants [2]										
8	.366	1.275	.313	.382	.063	.029	2.428	.169	2.597	.070
9	.368	1.243	.317	.395	.073	.029	2.425	.205	2.630	.055
10	.380	1.262	.285	.367	.047	.028	2.369	.096	2.465	.053
11	.397	1.006	.339	.470	.054	.031	2.297	.080	2.377	.080
12	.436	1.279	.441	.442	.081	.035	2.714	.897	3.611	.113
13	.362	1.200	.265	.343	.016	.016	2.202	.019	2.221	.053
14	.387	1.267	.266	.189	.034	.007	2.150	.033	2.183	.058
15	.406	1.222	.289	.242	.035	.024	2.218	.085	2.303	.042
16	.363	1.241	.296	.282	.034	.008	2.224	.031	2.255	.080
17	.427	1.203	.326	.241	.047	.029	2.273	.151	2.424	.090
18	.405	1.817	.271	.409	.050	.036	2.988	.217	3.205	.048
19	.361	1.635	.267	.354	.037	.036	2.690	.086	2.776	.048
20	.444	2.122	.261	.303	.050	.021	3.201	.245	3.446	.045
21	.430	1.717	.258	.331	.052	.032	2.820	.230	3.050	.048
22	.470	1.551	.256	.289	.025	.036	2.627	.055	2.682	.097
23	.367	1.185	.284	.286	.028	.026	2.176	.056	2.232	.070
24	.335	1.528	.167	.290	.015	.021	2.356	.010	2.366	.068
25	.335	1.817	.244	.356	.024	.029	2.805	.041	2.846	.071
Weighted average cylinder process plants	.382	1.344	.292	.349	.050	.027	2.444	.135	2.579	.059
Weighted average all plants	.406	1.200	.312	.345	.043	.027	2.333	.155	2.488	.052

[1] Includes 4 plants operated by the Fourcault sheet drawing process and 3 plants operated by the Libbey-Owens sheet drawing process.
[2] Includes 16 plants operated by the machine cylinder process and 2 plants operated by the hand cylinder process. The inclusion of costs for the two-hand cylinder plants has but a slight effect upon the average for the cylinder process group.

Tabulated also in the Preliminary Statement is the cost of production in cents per pound in plants grouped according to their location east or west of the Mississippi River. Of the total production 76.1% was made in the 17 plants located east of the Mississippi River and 23.9% in the 8 plants located west of the Mississippi River. The weighted average costs of production for all of the plants east of the Mississippi River including direct labor, power and heat, raw materials, manufacturing material, repairs and maintenance, general plant and office overhead, totaled 2.325 cents per pound. For the plants west of the Mississippi River the costs averaged 2.360 cents.

The weighted average cost in cents per pound of production, 1926, for all plants investigated and the cost in cents per pound of production by plant department is given.

Equivalent weighted average costs per box of 50 square feet of glass are tabulated on the following pages.

Elements of Cost: Belgium

The cost periods covered by the investigation of 13 Belgian companies included five companies from January 1 to December 31, 1926; three companies July 1, 1926, to June 30, 1927; two companies August, 1926, to July 1, 1927; one company April 1, 1926, to March 31, 1927; two companies November 1, 1925, to October 30, 1926. Ten of these companies used the Fourcault process and produced all the Fourcault glass made in Belgium in 1926. Three companies used the mouth-blowing process and produced approximately 40% of the mouth-blown glass.

The same form of schedule as that used for determining United States costs was used for determining Belgian costs. The Preliminary Statement shows the conversion of Belgian unit costs in francs into unit cost in dollars for direct comparison with domestic unit costs, by two different methods:

Method No. 1. Belgian francs converted to American dollars at average rate of exchange for period costed.

Method No. 2. Belgian francs converted to American dollars at average rate of exchange for period costed and six months previous.

The monthly average exchange rates for Belgian francs, in 1925, 1926, 1927, are given. Belgian cost per pound of production by plant, process, and cost items is detailed and the departmental costs of production for ten sheet glass drawing plants is given in cents per pound.

Wage Rates in the United States and Belgium

Skilled workers in the window glass industry of the United States received in 1926 from $6 to $8 per day of eight hours; semi-skilled workers from $4.50 to $6 and unskilled workers from $3 to $4 per day. Available information indicates that there has been no appreciable change in the wages of window glass workers in the United States since 1926. The wage rates in the Belgian factories are lower than those in the United States.

Table F

Window Glass: Belgium. 1926. Cost of production by plants, grouped according to process of manufacture, with the weighted average for each group of plants and for all plants combined, per box containing 50 square feet as single strength thickness. Conversion by method No. 1 from franc cost at the average rate of exchange for the period as costed.

Plant No.	Cost Items									
	Direct labor	Power and heat	Raw materials	Manufacturing materials and supplies	Repairs and maintenance	General plant overhead	General office overhead	Total	Imputed interest a/	Total with imputed interest	Selling expense
	-- Dollars per box --										
Sheet drawing process plants											
1	$0.240	$0.283	$0.168	$0.223	$0.099	$0.117	$0.018	$1.148	$0.091	$1.239	$0.002
2	.185	.209	.156	.195	.056	.139	.036	.976	.051	1.027	.002
3	.196	.189	.176	.207	.077	.055	.028	.928	.049	.977	.001
4	.178	.174	.157	.234	.101	.086	.038	.968	.020	.988	.003
5	.194	.206	.167	.213	.100	.119	.041	1.040	.065	1.105	.002
6	.187	.218	.174	.212	.032	.123	.015	.961	.037	.998	.006
7	.227	.281	.162	.230	.093	.104	.019	1.116	.049	1.165	-
8	.181	.214	.164	.168	.075	.108	.010	.920	.048	.968	.001
9	.172	.206	.156	.175	.069	.113	.020	.911	.049	.960	-
10	.210	.240	.141	.168	.040	.113	.019	.931	.049	.980	--
Weighted average sheet drawing process plants	.193	.216	.162	.203	.076	.106	.026	.982	.049	1.031	.002
Cylinder process plants.											
11	b/ .520	.327	.107	.193	.031	.040	.018	1.296	.049	1.345	-
12	b/ .579	.313	.116	.192	.024	.053	.019	1.296	.049	1.345	-
13	.354	.403	.125	.127	.059	.112	.040	1.220	.049	1.269	.007
Weighted average cylinder process plants	.540	.336	.113	.181	.034	.057	.022	1.283	.049	1.332	.001
Weighted average all plants	.274	.244	.151	.198	.066	.095	.025	1.053	.049	1.102	.001

a/ Imputed interest is calculated at 6 per cent of the value of fixed assets for plants 1, 2, 4, 5, 6 and 8 for which investment data were secured. The average interest charge for these plants, representing 48 per cent of the total boxes produced, is used for the other plants for which investment data were not available.

b/ Includes indirect labor, which is included under general plant overhead for the other plants.

(The basis for an allocation of general office overhead expense between production and selling expense is not available. Most of the plants estimated that 10 to 15 per cent would cover the amount of general office overhead expense applicable to selling expense.)

Wages in Belgium were increased four times in 1926. In January, 1926, the average wage in paper francs was 26.95 francs per employee (which, when converted into American dollars on the basis of exchange is $1.22, and on the basis of cost of living $1.68). Wages were increased on June 1, 1926 in practically all window glass plants; the increase amounting to 7.14%. A second increase was made in July, a third in October, and a fourth in November. Since November, 1926, no change in wages has been made in the window glass industry.

The wages paid in a representative plant in Belgium in 1928, converted into United States dollars are as follows:

Average wages paid, by conversion method No. 1 amount to $0.97. Wages of boys, $0.25 to $0.45. Highest wage paid (foreman) $1.09.

The workers in the Belgian window glass plants are organized in four crafts unions. In all except one of the Fourcault plants the unions are recognized by their employers, wages being determined upon collective bargains. Although the employers are not formally organized in labor matters, informal understandings result in uniformity throughout the industry.

From comparative data obtained in the commission's cost of production investigated the relative productivity of workmen in 25 plants in the United States and 8 Belgian factories has been calculated as shown on the next page.

Table I

Window Glass: Belgium. 1926. Departmental cost of production, for *sheet drawing process plants*, showing the cost for each plant and the weighted average cost for all plants, per box containing 50 square feet as single strength thickness. Converted by method No. 1 from franc cost to American dollars at the average rate of exchange for period as costed.

Plant No.	Departments							Imputed interest a/	Total with imputed interest	Selling expense
	Mixing	Melting, drawing, blowing, and annealing	Cutting	Packing	Warehousing	Shipping	Total			
	Dollars per box									
Sheet drawing process plants:										
1	$0.176	$0.639	$0.090	$0.253	$0.003	$0.007	$1.148	$0.091	$1.239	$0.002
2	.162	.519	.064	.203	.006	.002	.976	.051	1.027	.002
3	.188	.426	.066	.218	.006	.010	.926	.049	.977	.001
4	.164	.456	.098	.242	.003	.005	.968	.020	.988	.003
5	.175	.485	.131	.235	.007	.007	1.040	.065	1.105	.002
6	.163	.458	.090	.214	.002	.014	.961	.037	.998	.006
7	.171	.608	.095	.239	-	.003	1.116	.049	1.165	-
8	.171	.492	.075	.177	-	.005	.920	.048	.968	.001
9	.164	.479	.070	.189	.002	.007	.911	.049	.960	-
10	.147	.514	.096	.165	-	.009	.931	.049	.980	-
Weighted average, sheet drawing process plants	$0.170	$0.498	$0.081	$0.213	$0.003	$0.007	$0.982	$0.049	$1.031	$0.002

a/ Imputed interest is calculated at 6 per cent of the value of fixed assets for plants 1, 2, 4, 5, 6 and 8 for which investment data were secured. The average interest charge for these plants, covering 62 per cent of the boxes produced, is used for the other plants for which investment data were not available.

Total days operated, United States, 6,295 days, Belgium, 2,290.

Average number of employes per plant, United States 334, Belgium 372.3.

Total man-days, United States 2,102,614, Belgium 852,-567.

Production in boxes (50 square feet) United States 10,-867,171, Belgium 3,020,421.

Average production per man-day in boxes, United States 5.17, Belgium 3.54.

Glass Sand

Glass sand delivered at plant in Belgium costs $0.66 per short ton, compared with $3.84 per ton in the United States. Soda ash, Belgium $15.57, United States $29.99. Salt cake, Belgium $11.08, United States $22.84. Lime, Belgium $1.09, United States $7.18.

Transportation Costs

Belgian window glass for export to the United States is concentrated at the port of Antwerp. The weighted average freight charges from the plants to Antwerp together with the lading charges at Antwerp have been included in the Belgian costs of production as set up f.o.b. Antwerp.

The transportation and other charges to the principal seaboard ports of entry in the United States are itemized. Some of the items are ocean freight to Boston, New York, Philadelphia, Baltimore, 20 cents per 100 pounds. To Jacksonville 23.0, New Orleans 20.5, Los Angeles, San Francisco, Portland and Seattle 28.05. Marine insurance costs 0.5 cents per 100 pounds to all of the four first mentioned cities. 1.0 cent to Jacksonville and New Orleans, 1.5 cents to the four last mentioned cities. Wharfage and landing charge at Boston 1.5 cents per 100 pounds, New York 5.0, Philadelphia, Baltimore, Jacksonville, New Orleans, 3.0, Los Angeles 12.5, San Francisco 0.75, Portland and Seattle 2.05. There is a customs entry fee at all ports of entry of 1 cent per hundred pounds and the total transportation charges run from 23.0 cents per 100 pounds at Boston to 43.5 cents at Los Angeles. From Antwerp to New York, for instance, the total transportation charges amount to 26.5 cents per 100 pounds.

Freight rates (1926) for domestic window glass from the various plants to seaboard ports and important interior centers of consumption are given. Also movements and transportation charges for domestic window glass from each producing district to the principal markets.

In Appendix A to the Preliminary Statement, the cost of production (United States 1926) is given by plants grouped according to process of manufacture, with the weighted average cost per box of 50 square feet for each group and for all plants combined. The investigation included four Fourcault plants, three Libbey-Owens Sheet Glass process plants, sixteen machine cylinder plants and two hand operated cylinder plants.

Itemized production costs are compared from tables prepared by the Tariff Commission which show United States and Belgian costs per box for direct labor, power, heat and light, raw materials, manufacturing materials and supplies, repairs and maintenance, general plant overhead, general office overhead.

Cost Details for Both Countries

COMPARISON OF WEIGHTED AVERAGE COST OF PRODUCTION (1926) PER BOX, CONTAINING 50 SQUARE FEET AS SINGLE STRENGTH THICKNESS.

Cost Items	Belgium Method of Conversion No. 1*		United States	
	—Dollars Per Box—			
Direct labor		0.274		0.784
Power, heat and light:				
Labor	.020		0.019	
Coal	.206		.290	
Electricity	.018		.037	
Total		.244		.346
Raw materials:				
Sand	.011		.061	
Soda	.074		.114	
Salt cake	.033		.042	
Lime	.006		.026	
Cullet	.027		.091	
Other	.000		.011	
Total		.151		.345
Manufacturing materials and supplies:				
Packing cases	.162		.210	
Straw, paper, etc.	.016		.012	
Refractories	.009		.017	
Other	.011		.016	
Total		.198		.255
Repairs and maintenance:				
Furnaces	.053		.074	
Drawing machines	.009		.036	
Other	.004		.016	
Total		.066		.126
General plant overhead:				
Indirect labor	.009		.072	
Watchmen, guards and ground maintenance	.004		.009	
Plant and administrative salaries	.004		.043	
Office supplies and expense	.001		.005	
Royalties	.035		.050	
Depreciation	.027		.160	
Insurance and taxes	.010		.041	
Other	.005		.022	
Total		.095		.402
General office overhead:				
Administrative and office salaries	.018		.053	
Office supplies and expense	.004		.013	
Other	.003		.009	
Total		.025		0.075
Total cost, f. o. b. plant, without interest	1.053			2.333
Imputed interest†	.049			.155
Total cost, f. o. b. plant, with interest		1.102		2.488
Transportation in Belgium to Antwerp¶		.028		.....
Total, including transportation in Belgium		1.130		.....
Selling expense§		.001		.052
Total, including selling expense		1.131		2.540
Production, as single strength—boxes		5,653,532		11,267,651
Number of plants reported		13		25

*Belgian francs converted to American dollars at average rate of exchange for period costed.

†Imputed interest is calculated at 6 per cent of the value of fixed assets for six plants. The average imputed interest charge for these plants, covering 48 per cent of the boxes produced is used for the other plants for which investment data are not available.

¶Actual transportation costs are not available. These figures are calculated and include the cost of loading on steamer.

§The basis for an allocation of general office overhead expense between production and selling expense is not available.

Glass Industry

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The Tariff Commission's Report

The preliminary statement of information obtained in the pending investigation into the cost of production of window glass, here and abroad, is a document of first class importance to the American window glass producer. It contains a mass of data and statistics of value to all who are interested in the manufacture, uses and sale of this commodity.

The survey has been made with painstaking care and with an amount of detail that makes this publication one of more than temporary value.

The outstanding feature of this study is the extent of the difference in costs, prevailing in this country and abroad. While this was generally known to be considerable, it was a surprise to learn the actual cost figures with reference to labor, materials, transportation, selling expenses and general overhead charges.

These differences are due to three distinct causes: the lower general level of all cost items in Europe, the lower standard of living, prevailing in the industry and, last but not least, the difference in efficiency of the manufacturing methods. The latter phase is of especial interest to the technical man.

As has been pointed out previously in this column, the Belgians, pioneers as they are in the Fourcault process, have a distinct advantage not only over the machine cylinder plants here, but also over the Fourcault plants, in operation in the United States. Although the latter are constantly improving their methods, with a resulting lowering of cost, it will be some time until they will equal the high output generally obtained in Belgium.

At the coming hearing, which will begin at Washington on August twenty-first, these facts will undoubtedly be recognized, and with the evidence available, all indications point to the granting of substantial relief in the form of adequate protection of the American window glass industry.

The Art of Fire

To the student of the history of the glass industry has recently become available one of the oldest descriptions of this ancient craft, published in the year 1540 in Venice, when Murano was the center of the world's glass industry.

Contrary to the custom of that time, the book was not written in Latin, but in the Italian language. The author, Vannoccio Biringuccio, born in the year 1480 in Siena called it "De la Pyrotechnia." As the title indicates, it comprises every application of fire to technology, known in that time: metallurgy, ceramics and glass making. Through a German translation by Dr. Otto Johannsen it has now become accessible to the modern reader.

This description of the glass industry, as practiced at the time when Columbus discovered this continent, gives an interesting picture of the high state which the art of glass making had reached in that far distant day. It describes the glass furnaces, the making of colored glass by means of a frit, containing the coloring material as still practiced in Europe to some degree at the present time. Of interest to the modern glass decorator are the methods to apply metallic gold, silver and copper to glassware, the making of

imitation precious stones, and various glass specialties, for which Murano was famous.

After describing the beauties of glass the author muses: "The properties of glass are marvelous. But when one considers the shortness of its life, due to its fragile nature, one should refrain from becoming too much attached to it. We should keep it before our eyes as a reminder of how frail and uncertain are human life and the goods of this world, in spite of their beauty."

Glass Lighting Unit Again in Vogue

BY THEODORE LENCHNER[1]

A careful survey of the National Lighting Equipment Exhibition at the convention of the Artistic Equipment Association held recently in Chicago, reveals the fact that there has been a gradual change in the thought of the public as regards glass shades or units as a medium for diffusing the light from an electric lamp. For these past few years the frosted or colored ball lamp has been in vogue, without shading, or the glass shades have been replaced by such imitative material as silk, parchment, mica, etc. This situation has been very disturbing to the interests of the glass unit manufacturers and it was therefore pleasing to note that fully two-thirds of the exhibits shown, displayed the diffusion of light through glass units. Especially was this true on chandeliers, wall brackets and floor lamps.

The exhibit showed that considerable thought had been given to design and that the "hit and miss" fixtures and shades in vogue for some time past is surely disappearing. The displays also showed a closer cooperation between the lighting fixture manufacturer and the glass manufacturer. This is as it should be for no glass lighting unit can be designed apart from the fixture for which it is intended. The competitive contest among the A. L. E. A. members brought forth some very interesting and charming units tastefully designed to their fixtures, and the interest created thereby will no doubt prove of inestimable value towards the return of the glass shade. The exhibit also brought out the facts that the lighting unit must not only be pleasing in appearance when lighted and unlighted, but that it should be free of glare, and that the lamp within the unit should be entirely concealed from view. Again the total light output of the unit should not be less than 40 per cent of the total luminous output of the lamp within and could be as high as 70 or 75 per cent. Further, the unit must be of such design so as to provide a desirable distribution of light throughout the area on which it is to be used and that there are no objectionable streaks or shadows on the walls, ceiling or floor.

The new modernistic trend in design was shown to advantage in both fixtures and glass units. Some very clever designs and decorations embodying the modernistic thought were on display not only in the small shade, but in the large units and floor lamps as well.

Glass, the natural material for the diffusion or shading of light, it would appear has come to its own and the present day manufacturer should not overlook the opportunity to further develop the use of glass units through the medium of artistically created shades—artistic both in shape and decorative design. There is now presented a wonderful opportunity to bring this branch of the glass industry to a plane higher than has ever before been reached. This, as stated, can be accomplished only through correct design and decoration. The imported glass lighting units show the way to such an accomplishment and it is not beyond our manufacturers to attain at least the level of imported ware. And in this connection it might be stated that prices asked for fine foreign ware were not so low as to be beyond the hope of American competition.

The characteristic American ingenuity and ability to turn out ware under production conditions will easily compete in price with the product of our neighbors across the waters. Only through efforts in the direction outlined will glass lighting units endure and once more take their place as the leading medium for the shading of light.

[1] Roessler & Hasslacher Chemical Company.

Conference on Drug and Pharmaceutical Containers

A preliminary conference of representatives of the drug and pharmaceutical industries and the Glass Container Association was held at the Department of Commerce, under the auspices of the Division of Simplified Practice on July 6, 1928. The purpose of the meeting was to discuss the need for simplification of glass containers used in the drug and pharmaceutical industries also the appointment of a joint Simplified Practice Committee to make a survey of the whole field with the view of working out a simplified practice program which would be satisfactory to all concerned.

The representatives of the Division of Simplified Practice presiding at this meeting spoke of the service which the Division offers to industry in connection with the development and promulgation of simplified practice programs. Letters were also read from a number of the drug and pharmaceutical associations expressing the opinion that the appointment of a central or joint Simplified Practice Committee would be practicable and desirable. These associations not only approved of simplification, but offered full cooperation in connection with the movement.

The Chairman called upon each representative present at the meeting for an expression of opinion. They responded favorably and after some discussion of the general subject, a motion was made and unanimously carried that a joint standardization and simplification committee be appointed to consist of one voting delegate and two associate delegates from each of the national drug and pharmaceutical associations and the Glass Container Association of America in cooperation with the United States Department of Commerce for coordinating the efforts of the various groups concerned in the simplification and standardization of glass containers used in the drug and pharmaceutical industries.

It was urged that the appointment of the committee be completed as soon as possible with the view of holding its first meeting during the week of August 6 for the purpose of organization and that this first meeting be held at the Department of Commerce under the auspices of the Division of Simplified Practice.

Sixteen associations interested in the drug and pharmaceutical industry are to be invited to appoint one voting delegate and two associate delegates to serve on the joint committee referred to above.

Among those attending the meeting were J. L. Bacon and Edmund W. Maule of Whitall & Tatum Company and W. S. Richards of Illinois Glass Company, the latter representing the Glass Container Association.

Investigating Perfume and Toilet Bottle Costs

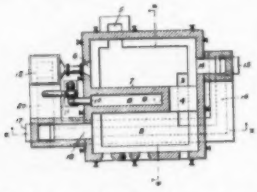
Notice has been issued by the United States Tariff Commission that an investigation of the differences in cost of production, and of all other facts and conditions enumerated in Section 315 of title III of the Tariff Act of 1922 will be held at the office of the Commission at Washington, D. C., or at other places to be designated. Proper notice of the investigation will be given by publishing the order in Treasury Decisions and Commerce Reports and posting it at the Commission's offices in Washington and New York.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

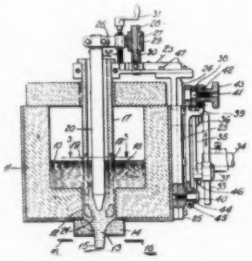
Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington D. C. Price 10c each

MELTING FURNACE. U. S. 1,675,542. July 3, 1928. Chauncey E. Frazier, Washington, Pa. Filed 8/4/26. In a melting furnace of twin construction adapted to carry in its lower portion the material under treatments and in its upper portion a heat-giving gaseous stream and including melting and working chambers arranged side by side, the said furnace being provided with a fuel port and with a delivery port for the gaseous products of combustion and being further provided at the downstream end of the melting chamber with a second delivery port, a recuperator for fuel in operative relation to the inlet port, passageways leading from the two delivery ports to said recuperator, and means for varying the effective relative areas of said passageways.



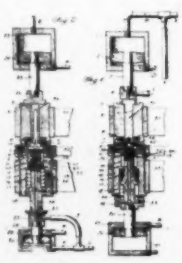
APPARATUS FOR AND METHOD OF DRAWING GLASS. U. S. 1,674,530. June 19, 1928. Arthur E. Spinasse, Mount Vernon, O. Filed 10/16/15. Divided and this application filed 2/11/20. An apparatus for and method of drawing glass wherein the shield for shielding the drawing area from the heat of the furnace is supported so that it may be shifted laterally relative to the segregating member which segregates the portion of glass from which the article is to be drawn for controlling the thickness of the walls of the article.

APPARATUS FOR FEEDING MOLTEN GLASS. U. S. 1,675,819. July 3, 1928. K. E. Peiler, West Hartford, Conn., assignor to Hartford-Empire Co. Filed 1/27/23. In apparatus for segregating mold charges from a body of molten glass, the combination with a glass container provided with a discharge outlet, of a plunger operable within the container and having an internal flow passage for the glass to the outlet, a flow resistance regulating member adjustable in said passage relative to said discharge outlet, and means for actuating said plunger to periodically accelerate and retard the flow of glass at the outlet.



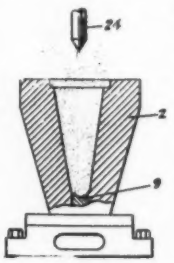
SHEET-FLATTENING MEANS. U. S. 1,670,146. May 15, 1928. Arthur E. Fowle, assignor to Libbey-Owens Sheet Glass Co., Toledo, O. Filed 1/30/25. In sheet glass apparatus, a receptacle containing a mass of molten glass, a bending roll, a draw-table for drawing a sheet from the mass of molten glass, said sheet being deflected over the bending roll into substantially a horizontal plane, a non-corrosive alloy member arranged between the bending roll and the draw-table for supporting the sheet and over which the sheet may be dragged to flatten the same.

NONPULL PLUNGER FOR BOTTLE-MAKING MACHINES. U. S. 1,670,821. May 22, 1928. Henry J. Pawling and Harry A. Crispin, Salem, N. J., assignors to Salem Glass Works. Filed 6/19/25. According to existing practice bottles made by machines frequently have irregular sealing surfaces, due to the adherence of the glass to the plunger as it is withdrawn during the blank and neck forming operations. In such cases it is difficult to form a tight seal or closure. The present invention eliminates this defect by providing a non-pull plunger which may be readily applied to existing machines.



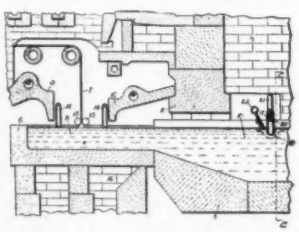
LAMINATED GLASS AND PROCESS OF PRODUCING THE SAME. U. S. 1,670,435 and 1,670,436. May 22, 1928. Wilbur F. Brown, Toledo, O., assignor to Libbey-Owens Sheet Glass Co. Filed 5/10/26. A process for producing laminated glass wherein one side each of two sheets of glass has formed thereon a skin of cellulose composition material, the skins preferably being permitted to dry, after which they are coated with a film of preferably non-solvent animal oil, then interposing a sheet of non-brittle material between the coated surfaces of the two sheets of glass, and then uniting the three sheets.

PROCESS AND APPARATUS FOR PRODUCING CRACKLED GLASSWARE. U. S. 1,675,951. July 3, 1928. David L. Middendorf, Columbus, O., assignor to Federal Glass Co. Filed 2/4/26. Divided and this application filed 6/21/26. The method of manufacturing crackled glassware which comprises pressing a blank and impinging atomized water against a surface thereof before such blank is shaped to final form. In combination with press and blow apparatus, means for producing a blank to be blown, means for blowing the blank, and means for throwing a fluid against the blank before blowing of a quantity and quality to produce crackling in the finished article and without changing the temperature of the blank to a degree that will prevent proper shaping thereof.



METHOD AND APPARATUS FOR MANUFACTURING FIRE-POLISHED SHEET GLASS. U. S. 1,677,095. July 10, 1928. Charles J. Jordan, Woodbury, N. J., assignor of one-fourth to Rudolph G. Schaub. Filed 11/11/25. An apparatus for forming fire-polished wire reinforced sheet glass consisting in a pot provided with a pair of spaced slots, and being in communication with a furnace, said pot provided with a third slot equi-distant of said first named slots, means for regulating the active width of said first named slots, guides, extending diagonally from the first named slots and converging at a point remote from the pot and in alignment with said third slot, and air domes in said pot over said first named slots to apply air pressure to molten glass in the pot and means for controlling the communication between the pot and the furnace.

DRAWING SHEET GLASS. U. S. 1,667,145. H. N. Diederichs, April 24, 1928. Charleston, W. Va., assignor to Libbey-Owen Sheet Glass Co. Filed 5/5/24. An additional cooler or heat-absorbing body is positioned transversely of the molten glass flowing from the glass-producing furnace into the receptacle from which the sheet is drawn. The lower portion of this cooler projects downwardly a short distance into the path of the flowing glass, so as to obstruct its passage and force the glass to flow down beneath the cooler. In this way the cooler functions to force a deeper flow of the surface strata of glass to the sheet source.



METHOD AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,670,110. May 15, 1928. Frank Fraser, Toledo, O., assignor to Libbey-Owens Sheet Glass Co. Filed 10/27/24. A mold for forming finished plate glass formed from a non-corrosive metal alloy comprising a body portion, a removable member arranged within the mold and supported by the bottom thereof, and a pivoted side wall carried by the mold to permit the removal of the said plate.

METHOD AND APPARATUS FOR FORMING CONTINUOUS SHEET GLASS. U. S. 1,673,907. June 19, 1928. Enoch T. Ferngren, Toledo, O., assignor to Libbey-Owens Sheet Glass Co. Filed 10/16/25. The molten glass flows from an extension of the tank or other container, down around an improved type of guiding and regulating member into a trough or recess in the top of an upper directing member or spill-bar. The glass overflows from this trough in even streams down around the two sides of the spill-bar, these streams uniting at the lower edge of the spill-bar to form a single thick stream which is delivered to the upper surface of a second directing member positioned below the spill-bar. The molten glass flows around both sides of this lower directing member, the two streams uniting at the lower edge of the member and flowing or being drawn downwardly therefrom in sheet form.

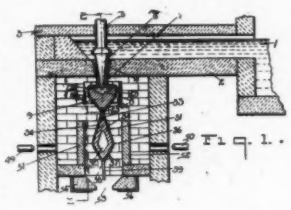
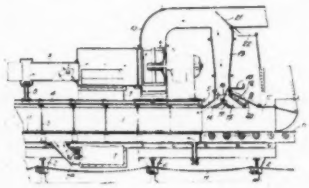


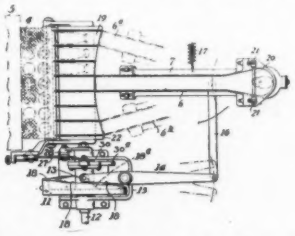
Fig. 1.

APPARATUS FOR ANNEALING GLASSWARE. U. S. 1,670,769. May 22, 1928. Everett O. Hiller, Hartford, Conn., assignor to Hartford-Empire Co. Filed 7/1/26. Apparatus for annealing glassware, comprising a tunnel, a plurality of flues associated with said tunnel, means for causing a heating medium to flow through one of said flues and a cooling medium to flow through another of said flues, means for transporting articles of glassware through said tunnel, means for directing a portion of said media into said tunnel, and means for shifting the direction of flow of said media longitudinally of said tunnel.



BLOWING GLASSWARE. U. S. 1,673,747. June 12, 1928. George E. Howard, Butler, Pa., assignor to Hartford-Empire Co. Filed 5/8/23. One object is to improve the distribution of the glass in the walls of the ware, while being blown, this object being attained, in general terms, by admitting the air to the interior of the glass in a succession of short and discontinuous puffs separated by intervals of reduced pressure.

GLASS-HANDLING APPARATUS. U. S. 1,667,714. May 1, 1928. R. G. Bacheller, Hartford, Conn., assignor to Hartford-Empire Co. Filed 5/28/26. An apparatus by which glassware may be placed in a lehr in definite relative positions and groups and in timed relation with respect to the movements of the blowing apparatus and the lehr.

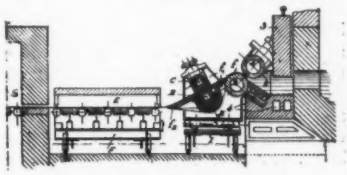


Transfer apparatus comprising an inclined slideway for delivering articles, a rack of greater width than the slideway, and having a plurality of article-receiving surfaces, means for oscillating the delivery end of the slideway to deposit articles on said surfaces, and means for periodically tilting said rack to effect discharge of the articles deposited thereon.

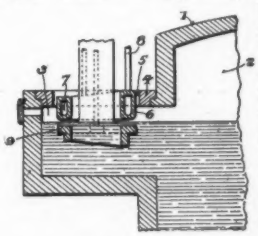
METHOD AND APPARATUS FOR PRODUCING SHEETS FROM GLASS UNDER PRESSURE. U. S. 1,670,167. May 15, 1928. Joseph A. Reece, Toledo, O., assignor to Libbey-Owens Sheet Glass Co. Filed 1/30/25. A receptacle containing a mass of molten glass, a container within the molten glass for segregating a pool of glass from said mass, means for drawing a sheet from said pool, said container having an opening in its bottom through which glass passes from said mass to said pool and being provided with internal chambers, cover-tiles arranged above the mass of molten glass at either side of the container to protect the sheet being drawn.

GLASS POLISHING APPARATUS. U. S. 1,673,733. June 12, 1928. Chas. H. Christie, Butler, Pa. Filed 11/16/26. An improvement upon that disclosed in Patent No. 1,610,658, issued Dec. 14, 1926, which describes and claims a felt-supporting member that may be attached to or detached from a polishing block without disturbing the block. The present invention provides means whereby the felt-holding member is rigidly held against upward movement relative to the block, so that there will be uniformity in wear as between those portions of the felt beneath the block and those portions beneath the felt-holding member.

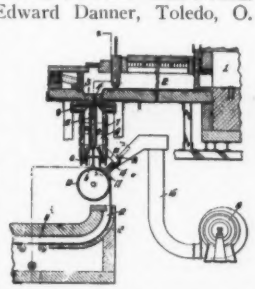
PROCESS AND APPARATUS FOR THE CONTINUOUS MANUFACTURE OF PLATE GLASS OR SHEETS OF GLASS. U. S. 1,675,217. June 26, 1928. Charles Heuze, Auvelais, Belgium. Filed 5/1/26. A process of manufacturing sheet or plate glass consisting in storing a mass of molten glass in a trough or receiver and causing said molten glass to flow up under pressure between rolling cylinders. The purpose of the present invention is to do away with the various drawbacks by modifying both the process inherent in previous processes for continuous pouring of molten glass and the apparatus, in such a way that the supply of glass and the rate of formation of the sheet are made essentially independent of the flow from the pouring lip as well as of the prevailing conditions in the furnace. The invention consists in no longer allowing the glass to flow to the rolling cylinders but in causing said glass to spout under pressure, the feed pressure being moreover adjustable as desired.



APPARATUS FOR DRAWING GLASS. U. S. 1,674,529. June 19, 1928. Arthur E. Spinasse, Mount Vernon, O. Filed 10/16/15. Divided and this application filed 2/11/20. In a glass tank furnace having a drawing area at one side of the mass of molten glass, a shielding member disposed above and relative to the glass so that the surface of the glass is substantially unbroken, said shielding member being shaped in vertical cross section so as to equalize the temperature effect of the body of the molten glass on the drawing area, and means associated with said shielding member and entirely submerged in the body of molten glass and operating to regulate the temperature effect of the mass through the molten glass on the drawing area.



METHOD AND APPARATUS FOR FORMING FIGURED GLASSWARE. U. S. 1,674,856. June 26, 1928. Edward Danner, Toledo, O. Filed 12/27/21. The method of forming figured glassware, which consists in continuously flowing glass in separated films down opposite sides of a heated directing member in the presence of a tempering heat, merging the films into a single sheet at the discharge end of the directing member and permitting it, while still soft, to flow into contact with and past a figured impression roll, and directing a fluid blast against the sheet in opposition to the member to force the glass against the member to take the impression thereof.



FEEDING MOLTEN GLASS. U. S. 1,675,273. June 26, 1928. John R. Keller, Glenshaw, Pa., assignor to Hartford-Empire Co. Filed 5/26/24. The method of feeding molten glass, that comprises placing the glass in a receptacle having a downwardly opening discharge outlet, and also having a stationary impelling member in contact with the glass in said receptacle and oscillating said receptacle around the axis of said discharge outlet, thereby causing the glass to issue periodically from said outlet.

Society of Glass Technology at Aachen

The last meeting of the session of the Society of Glass Technology, namely, that on June 28, was devoted mainly to reports of the proceedings of the recent Joint Meeting at Aachen between the Society of Glass Technology and the Deutsche Glastechnische Gesellschaft.

This meeting, which was stated to have been the first occasion in which a British and a German scientific society had met on German soil since the war, occupied three days, namely, May 22-24, and was marked by very generous hospitality on the part of the civic authorities and prominent local glass manufacturers, particularly of Messrs. Bicheroux and of the Stolberg Works of the St. Gobain Company.

The technical proceedings occupied two days. The first was devoted to Joint Committee work, presided over, the first part by Prof. G. Gehlhoff, Vice-President of the Deutsche Glastechnische Gesellschaft, the second part by Prof. W. E. S. Turner. Questions of methods and standards were the subject of consideration in three fields of glass technology, namely (1) the physical and chemical measurements on glass with special reference to the subjects of thermal expansion, viscosity and chemical durability, (2) the physical properties of glasses suitable for manipulation by automatic machinery and (3) modern developments in refractory materials suitable for the glass industry.

The leading contributors who presented considered reports to the discussion on section 1 were Dr. M. Thomas for the German Society; for section 2 Mr. F. W. Adams and Prof. Gehlhoff; for section 3 Mr. W. J. Rees and Dr. W. Miehr.

After the proceedings in Committee it was decided that a Standing Committee composed of representatives of each of the two Societies should be appointed to continue the discussion of the proposals formulated during the day and to make recommendations in regard to standards.

May 23 was devoted to an 8-hour sitting for the reading and general discussion of papers. Four were read on behalf of members of the Deutsche Glastechnische Gesellschaft, and four by members of the Society of Glass Technology, the papers being as follows:

"The Glass Melting Furnace as a Heat Engine." By Prof. Dr. D. Aufhäser, Hamburg.

"The Thermal Expansion of Glass and the Question of the Determination of Annealing Temperature." By Prof. W. E. S. Turner, Sheffield.

"The Velocity of Crystallization of Soda-Lime-Silica Glasses." By Prof. Dr. E. Zschimmer, Karlsruhe.

"Expansion and Tensile Tests on Glass House Refractories." By J. F. Hyslop, R. F. Proctor and H. C. Biggs. Research Laboratories of the General Electric Co., Ltd. (Presented by Mr. B. P. Dudding.)

"The Physical Properties of Clays." By Prof. Dr. G. Gehlhoff, Berlin.

"The Influence of Cullet in Glass-Making Operations." By Prof. W. E. S. Turner, Sheffield.

"The Amount of Gases and of Water Contained in Glasses." By Dr. Ing. H. Salmang, Aachen.

"The Annealing of Glass from the Point of View of Factory Operation." By E. A. Coad-Pryor, London.

Thursday, May 24, was devoted to visits to the large plate glass works at Stolberg (St. Gobain, Chaucy and Cirey) and to Herzogenrath (Messrs. Bicheroux & Co., Ltd.)

Nearly 60 British members of the Society of Glass Technology made the journey to Aachen and about 50 of these prior to the meeting carried out a series of visits to works and institutions at Berlin, Weisswasser, Dresden, Brockwitz, Hohenbocka, Frankfurt, Karlsruhe, Saarbrucken (St. Ingbert), Cologne and Essen. A number of members of the Society of Glass Technology resident in Holland, Belgium, France and Spain also attended the meeting at Aachen.

American Ceramic Society's Visit to England

In response to the joint invitation of the English Ceramic Society and the Society of Glass Technology, the American Ceramic Society has recently paid a successful visit to that country.

Some 70 odd members and friends arrived in London on June 21st, after making a tour through France, Switzerland, Czecho-Slovakia, Germany and Holland. They were received in London by the President and Secretary of the English Ceramic Society and the President and Secretary of the Society of Glass Technology. The National Federation of Clay Industries was also actively associated with the reception and banquet in London and the Refractories Association joined with the Society of Glass Technology in receiving and entertaining the visitors at Sheffield. At Stoke, the British Pottery Manufacturers Federation entertained the visitors to dinner and the Ceramic Society to luncheon on Wednesday, June 27th.

Except that a few members of the party attended the opening meeting of the new section of the English Ceramic Society to be devoted to the heavy clay products, the visit was occupied wholly with a round of visitations to works and of social functions. In London and district visits were paid to Messrs. United Glass Bottle Manufacturers, Ltd., Charlton, Messrs. James Powell & Sons (Whitefriars) Ltd., Wealdstone, Harrow, the General Electric Company's Research Laboratories and Glass Works at Wembley, and the Rockware Glass Syndicate, Ltd., at Greenford. Subsequently those interested in glass were taken to Stourbridge to visit the works of Messrs. Stevens & Williams, Ltd., Brierley Hill, and Messrs. Thos. Webb & Corbett, Ltd., Stourbridge, traveling on thence by way of Stoke to Sheffield, where they spent two days. One-half day was devoted to seeing the Department of Glass Technology, Sheffield and on the following day visits were paid to Messrs. Beatson, Clark & Co., Ltd., Rotherham, Messrs. Wood Bros. Glass Co., Ltd., Barnsley, Messrs. Redfearn Bros., Ltd., Barnsley, Messrs. John Lumb & Co., Ltd., Castleford, and Messrs. Hailwood & Ackroyd, Ltd., Morley. A large number of the party went to Pillinge to see the large brick-making plant of the London Brick Company & Forders, Ltd. Several who were interested in China clays visited St. Austell whilst other visits were paid to the Royal Worcester Porcelain Company, the Fireclay Works of Messrs. E. J. & J. Pearson, Stourbridge, a number of factories at Stoke-on-Trent, and to the County Potteries laboratory at Stoke. Subsequently those interested in refractory materials visited the works of the Derbyshire Silica Co., Ltd., Friden. Other visits in the Sheffield neighborhood were paid to Messrs. Pearson's Potteries, Whittington Moor, The Oughtibridge Silica Firebrick Co., and the Leeds Fireclay Company. The visitors left England with very sincere expressions that the English Ceramic Society and the Society of Glass Technology would very soon pay a return visit to America.

Feldspar in 1927

The crude feldspar sold or used by producers in the United States in 1927 amounted to about 202,497 long tons, valued at $1,424,755, or $7.04 a ton, according to reports obtained directly from producers by the United States Bureau of Mines, Department of Commerce, in cooperation with the geological surveys of Maryland, New York, North Carolina, and Virginia. These figures show a decrease of 4 per cent in quantity and 11 per cent in total value compared with 1926. Feldspar was mined and sold in 1927 in 12 States, namely, Arizona, California, Colorado, Connecticut, Maine, Maryland, New Hampshire, New York, North Carolina, Pennsylvania, South Dakota, and Virginia. The greatest feldspar-producing region is that which includes the Atlantic seaboard States, from Maine to North Carolina. This region reported about 94 per cent of the total production and value in 1927. North Carolina, the leading State, reported about 50 per cent of the total output; Maine, the second State, reported nearly 17 per cent; and New Hampshire, the third State, nearly 14 per cent. The average value per long ton in North Carolina was $6.08; in Maine, $8.72, and in New Hampshire $8.13.

Except for minor purposes, feldspar is prepared for use by grinding. This work is done principally by commercial mills; only a very small portion is ground by users in their own mills. In 1927 there were 32 commercial mills operated in 13 States, namely, California, Colorado, Connecticut, Illinois, Maine, Maryland, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania and Tennessee. These mills reported 223,915 short tons of ground feldspar sold in 1927, valued at $3,564,141, or $15.92 a ton, compared with 225,362 tons, valued at $3,775,797, or $16.75 a ton, in 1926, a decrease of less than one per cent in quantity and 6 per cent in value. Of the quantity sold in 1927, 194,672 short tons, valued at $2,946,154, or $15.13 a ton, was domestic feldspar, and 29,243 tons, valued at $617,987, or $21.13 a ton, was imported feldspar, including Cornwall stone.

The Glass World and What It Is Doing

News of the Industry

Flint Glass Men Change Name of Association

Having become dissatisfied with their inconveniently lengthy name, the American Association of Flint and Lime Glass Manufacturers at their annual meeting on January 16, at Atlantic City decided, on the recommendation of the committee appointed at the last meeting and headed by George Dougherty, to change the name of the organization to American Glassware Manufacturers, Inc. This undoubtedly is a move in the direction of modernity and efficiency. The election of officers for the coming year resulted in the re-election of C. M. Rodefer, president and treasurer of the Rodefer Glass Company, Bellaire, O., to the presidency. All the other officers, Wm. T. Gillinder, first vice president; George Dougherty, second vice president; E. P. Ebberts, treasurer; John Kunzler, actuary, also were re-elected, and C. B. Roe was made a director in place of the late W. M. B. Dalzell.

There was considerable discussion on the subject of changing terms of sales to customers. President Rodefer in his address alluded to the time in 1879 when 3% cash discount was given for payment within 30 days of invoice. Gradually the discounts were lessened, until in 1916 the present terms 1% in 15 days or 30 days net were established. The status today is that all invoices dated from the first to the fifteenth of any month may be paid on or before the twenty-fifth of the same month with 1% discount. Bills dated any time during the latter half of the month may be paid on or before the tenth of the following month with 1% discount.

New Discounts on Window Glass in Effect

The American Window Glass Company on July 7 announced that their discounts for flat window glass in carload lots on orders accepted on and after July 17, 1928, for shipment into all parts of the United States, will be as follows:

Single strength B, Fourth and C qualities—1st bracket....89%
Single strength B, Fourth and C qualities—above brackets..88%
Double strength B quality—all brackets.....88%

"A" quality single strength and double strength, packed with or without paper, two points higher than "B" quality. All "A" quality will be labeled.

The above discounts are from the manufacturers price list dated April 23, 1928, f. o. b. factory, freight equalized with Pittsburgh, Columbus or such other points as may be deemed necessary from time to time.

Single strength "C" quality will only be sold in the following sizes—6x8, 8x10, 9x12, 10x12, 10x14, 10x16, 12x14, 12x16 and 12x18.

Boxing and fractional cutting charges extra as per circular of December 23, 1926. Usual terms.

A revised copy of the stocklist of the standard window glass sizes adopted by the Window Glass Manufacturers' Association and effective July 1, 1928, was enclosed with the announcement. For all sizes on that list the above discounts will apply. For all sizes not on that list an additional charge of 5% on the price of the glass will be made.

All orders and specifications are subject to the company's approval. The announcement stipulated that orders accepted by the company from July 7 and prior to July 17, 1928, at May 11th discounts, must be specified in time to enable shipments to be made prior to August 17, 1928.

National Window Glass Workers Complete Liquidation

At meetings of the Executive Board of the National Window Glass Workers at headquarters, Columbus, O., held June 29 and 30, 1928, President Siemer reported that the office equipment had been sold to the highest bidder and netted $678.00. What small property remained at the glass factory in Huntington was sold to James E. Riley for $5.00.

It was moved and seconded that the sum of $300.00 be set aside to purchase presents for retiring officers. In accordance with a previous decision of the Executive Board, that the balance in the treasury be distributed pro rata among members holding membership cards for the fiscal year ending June 30, 1928, a motion was made that the members be refunded $1.00 each, which practically absorbs the balance in the treasury after all liabilities and liquidation expenditures are met.

President Siemer reported that in accordance with the decision of the Executive Board at their last meeting, all of the records and paraphernalia of a historical nature were being held intact subject to the disposition of the Executive Board at this meeting. A communication was read from the University of Wisconsin, in which the application was made that all the documents of a historical nature be placed on file in their Labor Library. They also advised that the faculty is now engaged in writing a history of the window glass industry and its Labor Organizations, and that this history would not be completed for about three years. Letters were also read from President E. H. Gillot of the Window Glass Cutters and Flatteners' Association of America, Inc., requesting that their Association be made the custodian of all records and paraphernalia of an historical nature.

After quite a lengthy discussion, a motion was made and seconded that the Cutters' League be made custodian of these records and paraphernalia. This motion was amended and the amendment, accepted by the mover and seconder, was that these records and paraphernalia remain the property of the present President, Secretary and Trustees of the Association to be subject to their disposition at any time, and in the event the National Window Glass Workers should be re-established as an organization in the industry, these records and paraphernalia are to revert to the organization.

American Ceramic Week

Plans have been completed for a national celebration of American Ceramic Week, in connection with the 31st annual convention of the American Ceramic Society at the new Stevens Hotel, Chicago, February 4-9, 1929.

Arrangements are being made to make this convention more unique and interesting than others held in the past. A feature will be the American Ceramic Exposition which is headed by D. F. Albery of the Northwestern Terra Cotta Company as chairman. There will be an elaborate showing of ceramic wares, including colored enamel ware, tiled rooms, stoves, refrigerators, sanitary ware, table glassware, ultraviolet glass and so forth. In addition there will be a complete exhibit of machinery, equipment and raw materials.

All trade associations in the ceramic field have been requested to plan their meetings to coincide with that of the American Ceramic Society and participate in the convention. A number have already agreed to do this.

Headquarters for the convention and exhibition have been opened at room 415, 3 West Van Buren Street, Chicago, Illinois.

The Chicago section of the American Ceramic Society, of which D. F. Albery is chairman and Wm. W. Wilkins secretary, is making a strong drive for a large attendance at the convention. Meantime a stag party and golf outing has been arranged for August 3, at the Nordic Country Club to which all members and their friends are invited. A "get together" meeting will be held, followed by luncheon and golf.

The Glass Industry in China

Next to Poshan in the province of Shantung, Tientsin is the best known glass manufacturing centre in North China. The industry was started on a small scale towards the close of the last century. In 1902 the Mou Tai Glass Factory financed with Japanese money was organized and in 1908, another Japanese-financed factory, the Yung Hsin, came into existence. These two works were staffed with experienced workmen engaged from Japan and a number of Chinese apprentices. Their operations were confined to the making of lamp chimneys and other kinds of glassware. Gradually as the number of Chinese workmen trained under the Japanese increased and became available,

numerous glass factories financed with Chinese capital sprang into existence and the total number of Chinese-owned factories reached 12 in 1913. Mismanagement and other causes, however, compelled two of them to close down after a brief career, leaving only ten in operation of which five were organized quite recently by the workmen of certain defunct glass factories. Only lamps, lamp chimneys, bottles, cup bowls, etc., are produced and with the exception of the two Japanese works all are operated on a limited scale. Attempts were made by a Tientsin merchant about twenty years ago to manufacture plate glass but work had to be suspended owing to improper management. Later on three more glass factories made similar attempts but these three works have since suspended operations. A part of the plate glass sold on the Tientsin market is turned out by the Yao Hwa Glass Factory, at Chinwangtao, Chihli province, and part imported from abroad.

June Construction Second Highest on Record

June construction contracts in the territory east of the Rocky Mountains broke all previous June records, according to F. W. Dodge Corporation. New building and engineering work contracted for last month in the 37 Eastern States (including about 91 per cent of the total country) amounted to $650,466,200. This figure was the second highest monthly total on record. It was 3 per cent ahead of the June, 1927, record and was only about two and one-half per cent under the total for the preceding month of this year.

Last month's contract total made another record. It brought the total amount of new construction work started in these states since the first of this year up to $3,444,867,500, which was the largest first six months' total on record. The increase over the first half of last year was 8 per cent.

The June contract record included the following important classes of work: $258,083,700, or 40 per cent of all construction, for residential buildings; $130,852,400, or 20 per cent, for public works and utilities; $93,942,200, or 14 per cent, for commercial buildings; and $63,536,700, or 10 per cent, for industrial projects.

Contemplated new work reported in June amounted to $1,030,095,000, being 17 per cent in excess of the May, 1927, total and 41 per cent ahead of the June, 1927, record.

The Arsenic Situation in Nova Scotia

Where the gold ores on a property contain a sufficient quantity of arsenopyrite, it has been found profitable to install concentrating equipment to save these sulphides. It is said that during the past year the Metals Mining and Smelting Corporation of Canada (Ltd.) treated about 40,000 tons of tailings from the dump at the Boston-Richardson property, Goldboro, and removed the arsenical concentrates therefrom. Shipments made last winter of these concentrates analyzed 37.87 per cent of arsenic and carried a gold content of one twenty-third ounce per ton, the price received for the metallic arsenic being two cents per pound.

While no substantial shipments of arsenical concentrates were made from the Province during the fiscal year, a large quantity was recovered from the mill tailings of the operating companies. These are being stored until a sufficient quantity has accumulated to warrant making a shipment. Other operators have been constructing or remodeling plants to enable them to recover the arsenical values from their respective ores. There are also many interested parties who have not sufficient working capital to develop mines or install the necessary equipment to mine or prepare this mineral at a cost and in a sufficient quantity to give adequate returns.

During 1925 shipments of barytes were made from Nova Scotia amounting to 339 short tons, but none have since been reported.—*World Trade News.*

American Refractories Institute Election

The American Refractories Institute, at the annual meeting at White Sulphur Springs, W. Va., elected the following officers and directors: President, J. M. McKinley, vice president and general manager, Crescent Refractories Company, Curwenville, Pa.; first vice-president, R. M. Sievers, vice-president and general sales manager, Evens & Howard Fire Brick Company, St. Louis, Mo.; second vice-president, W. B. Coullie, assistant general sales manager, Harbison-Walker Refractories Company, Pittsburgh, Pa.; Treasurer, C. C. Edmunds, treasurer, McLain Fire Brick Company, Pittsburgh, Pa.; Secretary, Miss Dorothy A. Texter, Pittsburgh, Pa.

Directors (3-year term) were elected as follows: G. A. Balz, president and general manager, Seaboard Refractories Company, Perth Amboy, N. J.; J. D. Ramsay, president, Elk Fire Brick Company, St. Marys, Pa.; J. E. Lewis, president, Harbison-Walker Refractories Co., Pittsburgh, Pa.; Burrows Sloan, president, General Refractories Company, Philadelphia, Pa.; A. P. Taylor, president, The Chas. Taylor Sons Co., Cincinnati, O.; A. P. Green, president, A. P. Green Fire Brick Company, Mexico, Mo; H. L. Tredennick, president, Haws Refractories Company, Johnstown, Pa.; T. N. Kurtz, president, U. S. Refractories Corporation, Pittsburgh, Pa.

Dates for Montreal Visit of Glass Container Men

The dates of the next meeting for the members of the Glass Container Association have definitely been selected as Thursday and Friday, September 27 and 28, 1928, and the Windsor Hotel, Montreal, Canada, has been selected as the meeting place.

No definite program has been announced but it will be for the most part a business and organization meeting and executives are urged to be present.

The Windsor Hotel announces room rates as follows: With hot and cold running water, single room $3.00; double room $5.00 and up. Single room with bath $5.00 up; double room with bath, $8.00, $9.00 and $10.00.

The Irish Free State Glass Trade

The official returns are now available relative to the imports into the Irish Free State during the past year. From these there has been compiled the appended table showing the imports of glass and glassware into that country during the period in question, as compared with 1926.

		1927		1926	
		Quantity	Value Dollars	Quantity	Value Dollars
Domestic and Fancy Glassware	Cwt.	15,943	215,450	17,871	242,355
Illuminating Glassware	.....	.....	201,875	.....	178,435
Plate Glass	Sq. ft.	209,040	162,740	209,143	186,615
Other Sheet Glass	Sq. ft.	2,851,941	205,705	2,667,880	205,255
Bottles (dutiable)	Gross	72,916	295,170	80,303	310,440
Bottles (non-dutiable)	Gross	1,162	12,740	1,174	12,870
Glass and Glassware, n.c.s.	Cwt.	2,005	71,270	3,361	94,555
Totals			$1,164,950		$1,230,525

A Great Glass Gatherer

According to a compilation published in *The American Flint*, official organ of the American Flint Glassworkers' Union and reviewed in the *Wheeling Intelligencer*, Joe Kleber, a member of the Union, is believed to have gathered more glass than any other man in the flint glass trade. The figures were compiled by David H. Jones of Bellaire, O., who bases his figures on the combined weight of the finished production.

From 1870 to 1873 Mr. Kleber gathered tumblers at an average of 12 ounces per piece. Allowing 600 per turn this makes 450 pounds and an average of nine turns 4,050 per week. It is estimated that in that particular branch he gathered in the three years 486,000 pounds of glass.

Kleber came to Bellaire in 1873, and from then to 1897 gathered heavy ware exclusively. On a basis of 3½ pounds to the piece and 250 pieces to the turn, nine turns per week and 40 weeks per year, he gathered in the 24 years a total of 7,560,000. In later years the unlimited system became effective. Thus, giving the average weeks per year at 44, the average of 3½ pounds per piece and 350 pieces per turn at nine hours per week, in the fourteen years at the Crystal and Imperial glass plants he gathered 6,791,400 pounds of glass, making a combined total of 14,837,400 pounds of finished product in the 41 years. This does not include the waste which is estimated at 1,500,000. It is conservatively estimated that while employed at his trade he has gathered upward of 20,000,000 pounds of glass, a record that will be hard to equal.

Art Gallery for Commercial Designers

The first cooperative art gallery, and the first in America devoted exclusively to showing objects designed for practical use in homes and businesses, has been founded by fourteen leading American designers, who have incorporated in the "American Designers Gallery." This will open with an exhibition early in October, in the Chase National Bank Building at 145 West 57 street, New York.

The member artists include architects, designers of interiors, glass, pottery, textiles, furniture, etc. The membership includes prominent professional men and women in these lines. It is planned to open the first exhibition in October with 12 complete rooms, each decorated in the modern style by a member artist. The success of temporary exhibitions of modern applied art such as have been held in New York during the past few years has aroused a great deal of interest but their value has been limited because they have been transitory. By providing a place where designers can exhibit their own things under their own conditions, the new Designers' Gallery should be of the greatest value to American decorative art and is expected will not only interest the public but stimulate the artists themselves. The Gallery will be in a position to serve as a research bureau in design. At present the large manufacturer can only guess whether or not the so-called modernistic designs will take hold of public favor. It is hoped that the new gallery will determine for both the designer and manufacturer what designs are best adapted for large production, by serving as a clearing house for ideas where both artists and manufacturers will be benefited. One idea behind the project is to help take modern art out of the museums and put it into every room in the home and every corner of business and industry. Mrs. Z. C. Brandt is acting as manager of the Gallery.

Wants to Locate Lost Relative

William Plummer, Jr., secretary-treasurer of Hires-Turner Glass Company, Philadelphia, Pa., has forwarded a copy of a letter received from Germany, with the suggestion that if published it might possibly lead to a reunion of lost relatives. The principal part of the letter follows:

"Will you be good enough and let me know whether there is in Philadelphia a plate glass factory 'Frido von Sylter.' Now this firm may trade under another name but what this name is I do not know, but would like to know the correct name as I have been trying for some time to find my uncle whose name is Adolph von Walter. He is a half brother of my father, Herman Hartung."

The letter is signed by Walter Hartung, Bremen, Germany, Cafe Central, Knochenhauer Str.

First National British Glass Convention

A meeting of the recently organized First National Glass Convention will be held at Bournemouth, England, from September 19-22. The convention will open on Wednesday, September 19, with an informal Presidential reception to members and their parties. On Thursday, the Presidental and other addresses will be delivered at the official luncheon. In the afternoon an address on Organization of the Glass Industry will be given and in the evening a Mayoral reception. On Friday there will be meetings of trade associations and a discussion on Legislation in the Glass Industry. In the afternoon the Society of Glass Technology will meet and a popular lecture will be given by Professor W. E. S. Turner. In the evening a banquet will be held with prominent guests present and on Saturday there will be motor excursions and a golf competition. Both the Society of Glass Technology and the Glass Manufacturers Federation of London are taking an active part in the convention.

Illuminating Engineers to Meet

The Illuminating Engineering Society, 29 West 39th Street, New York, of which Norman Macbeth is president, will hold its twenty-second annual convention at the King Edward Hotel, Toronto, Ontario, September 17 to 20, 1928. The society has assumed charge of the arrangements for the congress and tour to be held by the foreign delegates attending the first International Illumination Congress, of which the convention is to be a part. The tour will end at Toronto where the delegates will participate in the convention. Immediately following the Toronto convention the meetings of the International Commission of Illumination will open at Saranac Inn, New York State.

Plate Glass Half-Year Record Gains

Figures compiled by P. A. Hughes, secretary of the Plate Glass Manufacturers' Association of America show the production of polished plate glass for the month of June, 1928, was 10,723,056 sq. ft., as compared with 10,223,683 sq. ft. produced in the previous month, May, 1928.

This makes the total for the second quarter of 1928, 30,900,213 sq. ft., as compared with a total of 29,595,355 sq. ft. produced in the first quarter of 1928.

The total production for the first six months of 1928 was 60,495,568 sq. ft., as compared with a total of 57,831,090 sq. ft. produced in the first six months of 1927.

Libbey-Owens Erecting Laminated Glass Plant

Announcement was made some weeks ago by James C. Blair, president of the Libbey-Owens Sheet Glass Company, Toledo, O., that construction work would soon be started by A. Bentley & Sons Company to whom a building contract has been awarded for the first unit of a plant with a capacity of 10,000,000 feet of laminated glass a year. The building will be 80 feet wide by 600 feet and of steel and concrete construction. It is reported that operations have been planned so that by the beginning of next year the company will be giving employment to about 500 workers in addition to those employed in its two grinding plants located on the same site, both of which are now in operation.

The "Daylight" Signs

So popular have the imported daylight glass signs, so-called, which give the effect of an artificially illuminated sign by light reflections in a mirror become, that several glass manufacturers in this country have developed glass for use on delivery motors and wagons, and in store windows and elsewhere. The original "stippled" selenium glass for making signs of this type came from Chance Bros. & Company Ltd. of Birmingham, England. Paul Wissmach Glass Company of Long Island City, New York, with factory in Paden City, W. Va., have already brought out several types and colors and are adding others to their line. Semon Bache & Company of New York, Schrenk & Company, Hoboken, N. J., and others are importing the glass.

Belgian Interests Acquire Italian Alkali Plant

The Adria Soda plant in Monfalcone which has been producing approximately 100 tons of caustic soda and 50 tons of sodium carbonate daily was recently absorbed by the Belgian Solvay Company through the purchase of the majority of the Adria shares. The Solvay Company operates a large alkali plant at Rossignano near Milan which is reported to be capable of meeting the entire Italian demand. It is said that the purchase of Adria Soda was made to eliminate competition and it is feared that the plant at Monfalcone may be closed in the near future.—*World Trade Notes.*

Mexican Production of Antimony Reduced

In a report made July 11 by the Department of Commerce, the statement is made that Mexico is second to China in the production of antimony. The total production of Mexican antimony, however, was 25% less in 1927 than the previous year. Official figures placed last year's output at 1,894 tons compared with 2,573 tons the preceding year. The most important and productive field is that of the Altar district in the state of Sonora. The antimony deposits in this district occupy about 35 square miles. They are said to contain large deposits of relatively pure natural oxide of antimony.

Edward Orton, Jr. to Establish Laboratory

According to a Columbus, O., paper, a memorial laboratory dedicated to the use of ceramic industries and devoted quite largely to research work, will be built in that city at the corner of Eighth Avenue and Summit Street by Edward Orton, Jr., the famous leader in ceramics. The laboratory will not be a money-making institution but will be operated for the benefit of the industry and the public in general.

Will Investigate Blown Glass Tableware Industry

The United States Tariff Commission on July 12, 1928, ordered an investigation of the differences in cost of production of table and kitchen articles and utensils blown or partly blown, regardless of composition, description, or further treatment, manufactured in the United States, and similar articles produced in foreign countries. The date for a public hearing on the subject will be published later.

Wage Conferences

The usual summer wage conferences between representatives of the National Association of Fressed and Blown Glassware and the American Flint Glass Workers Union, which began July 17, were expected to be completed during the week beginning Monday, July 23. They included the pressed ware department, machine pressed department, punch tumbler department, chimney department, paste mold and iron mold departments, cutting, engraving, and mold making departments.

Big Glass Plants May Produce Their Own Sand

Reports have been in circulation during the past month to the effect that several of the largest glass manufacturing concerns in the country are considering the organization of a company to produce high grade glass sand for their own use. No confirmation of the report has been received.

Belgium May Raise Plate Glass Prices

In a report from the United States Consul at Brussels, Belgium, it is stated that plate glass companies are operating nearly at maximum capacity. Conditions are such that rumors are circulating to the effect that increases in prices which may amount to 10 or 15% are under consideration.

Trade Activities

The Natilly Glass Company, 714 Bush Street, Toledo, O., has filed an application for permission to increase its capital stock from $15,000 to $25,000.

C. W. Pleukharp, formerly with the Long Beach Glass Company, Long Beach, Cal., is now superintendent of the Puget Sound Glass Company, Anacortes, Wash.

The D. C. Jenkins factory at Arcadia, Ind., started in full operation on July 9. Both plants at Kokomo have also been working but No. 1 will be down for repairs about August 1.

Jacobo Simon, Correo Mayor, 53, Mexico City, Mexico, has been in this country investigating glassmaking equipment for a bulb making plant which it is proposed to establish in Mexico.

Harry McNeer, of McNeer Auto Company, Portsmouth, O., is reported to have organized a company and bought a large tract of ground nearby which contains glass sand said to be over 99% pure, with a view to starting a glass factory.

The New Martinsville Glass Manufacturing Company, New Martinsville, W. Va., have been building a new ten pot furnace which, according to Ralph E. McEldowney, General Manager, is to be put into operation about August 1.

Golding Sons Co. and Erwin Feldspar Company, Trenton, N. J., have appointed J. D. Pearson their sales representative, to call on the glass and enamel trade in Ohio, Western Pennsylvania, Western New York State and West Virginia. Mr. Pearson will make his headquarters at East Liverpool, O.

The National Sash and Door Company, Independence, Kan., has had their new sheet drawing equipment in successful operation for several months. They expect to add two additional machines within the next few weeks. The work is being done under the supervision of Walter J. Knothe without interfering with the present operations of the plant.

The Louie Glass Company's plant at Weston, W. Va., was seriously damaged by a wind storm on July 4. The blowing room had to be closed down for several days while repairs were made. The employes were taking a holiday at the time the accident occurred, otherwise several lives might have been lost when part of the roof of the main building and a heavy wall fell in.

American Flint Glass Worker's Union held its fifty-second annual convention at Cumberland, Md., beginning July 2. After a lively street parade, President Wm. P. Clarke opened the convention. J. P. Schellhaus of the Maryland Glass Company made an address outlining the history of the glass industry in the city of Cumberland. The activities of the convention continued well into the following week.

The Great Annual Fair, at Leipzig, Germany, the largest trade exposition in the world, will be held this fall from August 26 to September 1. The fair will attract buyers from forty-three countries, while a score of countries will send some 10,000 exhibits. Glassware is always prominently featured. America's growing activity in world markets is indicated by her sending upwards of 2,000 buyers and some fifty exhibits to the Leipzig exhibition.

The Atlantic State Shippers Advisory Board report that during the first 25 weeks of 1928, a total of 23,454,062 cars were loaded throughout the entire country, as compared with 24,529,602 cars for the same period of 1927, a decrease of 1,075,546 cars or 4.4%. The 18th regular meeting of the board will be held at Wilmington, Del., Thursday, October 4, 1928. J. C. Magness, of the Glass Container Association, is chairman of the Glass Container Committee of the Board.

The Midland Trail Glass Company, recently incorporated at Charleston, W. Va., with $50,000 capital, it is reported, will take over a plant at Culloden formerly occupied by another glass company and will manufacture tableware. Harry S. Irons is president, D. F. Merritt, of Scott, W. Va., vice-president and general manager, H. I. Smith, Hurricane, W. Va., secretary-treasurer. C. R. Miller and R. P. Asbury are other incorporators. It is said that approximately 150 men will be employed.

The Libbey-Owens Sheet Glass Company, Toledo, O., it is reported, has purchased the plant of the Whittemore Glass Company of Dunbar, W. Va., with the intention of using the tank for making cullet. Heretofore they have been producing cullet at the Dunkirk Window Glass Company plant at South Charleston. It was recently reported that the president of the latter company, George A. Schlosstein, had retired from business and that a large part of the equipment of the Dunkirk plant had been sold to outside firms.

The Society of Glass Technology of England to the number of about three score, including many prominent persons associated with the industry, made a tour in May to Germany. Dr. G. Gehlhoff and other members of the German Society of Glass Technology met the visitors on their arrival at Berlin and welcomed them to the city and saw that they got comfortably settled and were suitably entertained. Visits were made to glass factories. Among other activities of the Society on its tour was a visit to the German Society of Glass Technology at Aachen.

The Second National Fuels Meeting under the auspices of the fuel division of the American Society of Mechanical Engineers, will be held in Cleveland, September 17 to 20, 1928. The opening address will be by Thomas T. Baker, president, Carnegie Institute of Technology. Papers on fuels will be read. One of the general papers will be "Progress for Direct Firing of Boilers with Producer Gas," by W. P. Chapman, well-known producer gas engineer. The use of pulverized coal will be discussed by several experts. Smoke abatement is another subject on which several papers will be presented.

The General Electric Company recently announced another reduction, the eleventh since 1920, effective July 1, in the prices of Mazda incandescent lamps. The latest reductions average 14% and apply to types which represent about 82% of the total consumption of large Mazda lamps. The credit for the reduction is given by the company to the public, which has so concentrated the bulk of demand on the five lamps in the standard line of inside frosted Mazda lamps, that the company has been able to achieve increasing efficiency in mass production and greater economies in lamp distribution. The savings are being shared with the consumers to the extent of three cents and five cents on the most widely used types of lamps.

The Fostoria Glass Company, Moundsville, W. Va., whose large new addition to the plant is nearing completion, has announced that its capital stock will be increased from 10,000 shares of 100 par value to 30,000 shares. At the annual meeting July 31, shareholders will, it is expected, ratify the proposi-

tion for increasing the capital stock from $1,000,000 to $3,000,000. The plant, always noted for its tableware, goblets, stemware, and tumblers, cut glass and etched ware, has during the past few years greatly increased its output of colored and decorated glassware. With the added facilities which the new building will accommodate, a much larger production will be possible.

The Brown Instrument Company, Philadelphia, Pa., have announced the policy of furnishing die-cast aluminum cases as standard equipment with Brown recording thermometers and pressure gauges. The unusual size of the die-castings used on some of their equipment, continuous chart recorders, for example, are among the largest aluminum die-castings ever produced on a quantity basis. Those who are acquainted with the technical problems of practical die-casting will realize the difficulties involved turning out castings 15 by 13 inches in size and 7 inches deep. It is claimed that the aluminum cases have the advantage of lightness, resistence to rusting, and corrosion, and absence of flaws.

The National Glass Distributors Association, Eastern Division, will hold its fall meetings at the Hotel Traymore, Atlantic City on Wednesday, September 19 and the following Thursday and Friday. An announcement distributed by Secretary Carl F. Doerr outlines the program for Wednesday, including a meeting and dinner for members of the Eastern Executive Committee only, at the Hotel Traymore, 6:30 p. m. sharp. On September 20, at 10 a. m. the general meeting will be held with S. C. Gillmore presiding. At 1 p. m. a luncheon will be held at which all members and manufacturers will be welcomed. In the evening a dinner and entertainment will be held at 7 p. m. to which all members, manufacturers, and guests are cordially invited. On Friday there will be a golf tournament at the Northfield Country Club, Atlantic City, at which all are invited to play.

Coming Meetings

The American Bottlers of Carbonated Beverages will hold their annual convention and exposition at Detroit, Mich., Nov. 12-16.

The National Glass Distributors Association, Eastern Division, will meet at the Hotel Traymore, Atlantic City, September 19-21.

The Glass Container Association has announced that the next members' meeting will be held at Montreal, Que., sometime during September, the date and the name of the hotel to be announced later.

The American Society of Mechanical Engineers will hold its summer meeting at St. Paul and Minneapolis, Minn., August 27 to 30. Two hundred members from the East are planning a lake trip to Duluth on the boat which leaves Buffalo August 20.

The National Fuel Meeting under the auspices of the Fuels Division of the American Society of Mechanical Engineers will be held in Cleveland, September 17-20, 1928. An interesting and instructive technical program covering the use of solid, liquid and gaseous fuels in all fields, has been prepared.

Recent Death

H. C. Tuttle

Harry C. Tuttle, for many years identified with the glass industry in Pittsburgh and other districts, died at Pittsburgh Sunday, July 8. Mr. Tuttle was sixty-nine years old and until recently in good health. Services were at his late residence near Allison Park, Pa. Interment was at Wheeling, W. Va.

Inquiries Received

For further information address THE GLASS INDUSTRY

423. Where can we obtain Argentine glass mixing slabs?

424. We will thank you to give us any information you can regarding the manufacture of beer bottles, where to obtain the machinery and equipment necessary, grade of sand used, etc.

425. (Mexico) Please put us in touch with makers of incandescent lamp bulb-making machinery. We may decide to build a manufacturing plant.

What The World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

South America: 32169, glassware, pressed, cheap.

England: 32174, glass (opal jars) for toilet creams.

Brazil: 32,072, Glass, laminated, colored and plain; and plate crystal glass.

England: 32,073, Glass for paneling or decorative purposes.

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE, JULY 19, 1928

	Bid	Asked	Last
American Window Glass Machine, Com.	..	19½	19½
American Window Glass Machine, Pfd.	..	38	38
American Window Glass, Pfd.	87	..	..
United States Glass	..	..	14
Pittsburgh Plate Glass, Com.	230	..	..
Standard Plate Glass, Com.	..	..	4
Standard Plate Glass:			
Preferred cumulative	..	..	17½
Prior preferred	..	..	30

TOLEDO, O., JULY 25, 1928

	Bid	Asked	Last
Owens Bottle, Pfd.	115	..	115
Libbey-Owens Sheet Glass, Com.	122	128	127
Libbey-Owens Sheet Glass, Pfd.	115	..	117

WHEELING STOCK EXCHANGE, JULY 20, 1928

	Bid	Asked	Last
Hazel-Atlas	85½	86	86
Imperial	..	..	72
Fostoria	215	..	208
Central	..	..	75
Jefferson, Pfd.	..	..	96

READERS WANTS AND OFFERS

FOR SALE: 8 Hardinge Mills, 3' x 8", 5 x 22, 8 x 22, 8 x 30, 8 x 36. 1 Patterson Pebble Mill, silex lined, 7' 6" x 10, batch or continuous.

Send for your copy of our latest list of Crushing and Grinding Machinery.

Consolidated Products Co., Inc., 19-21 Park Row, New York City. Barclay 0602. Shop and yards at Newark, N. J., cover five acres.

For Sale: CULLET of all Descriptions
Free from Caps, Wires, etc.
GEORGE F. BAUMANN, Dealer,
1110 Carroll Street, Brooklyn, New York.
Carloads Ready for Immediate Shipment.

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Also Complete Sets or Bound Volumes of the Issues of 1921, 1923, 1924
Address, 50 Church Street, New York

Current Prices of Glass-Making Materials

July 23, 1928

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid			
Citric (dom.)	lb.	.46	.46
Hydrochloric (HCl) 20° tanks, per 100 lb.		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	.38	.38
Alcohol, denatured	gal.	..	.53
Aluminum hydrate (Al $(OH)_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.21
Ammonia water (NH_4OH) 26° drums	lb.	.03	.03¼
Antimony, metallic (Sb)	lb.	..	.09½
Antimony oxide (Sb_2O_3)	lb.	..	.13
Antimony sulphide (Sb_2S_3)	lb.	..	.13
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.05
Barium carbonate ($BaCO_3$)			
Precipitated	ton	57.50	60.00
Natural, powdered, imported	ton	45.00	50.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	08¼	.08½
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	28.00-35.00	..
Bone ash	lb.	.05	.05½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.02½-.03½	.02¾-.03¾
Boric acid (H_3BO_3)	lb.	.07-.07¼	.07¼-.07¾
Refined	lb.	.07-.07¼	.07¼-.08
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	1.10-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.27	.28
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	.	.30
Cryolite ($Na_3Al\ F_6$) Natural Greenland Kryolith)	lb.	.09	.10-.10½
Artificial or Chemical	lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.30
Feldspar—			
100 mesh	ton	13.00-20.00	15.50-22.00
80 mesh	ton	11.75	14.50
40 mesh	ton	11.00	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2, 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	.08	.08½
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.03¼-.07
Black (FeO)	lb.	.03½	..
Kaolin (f.o.b. mine)	ton	9.00	..
English, lump, f.o.b. New York	ton	14.50	24.50
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	.087-.09¾	.09¾-.10
Litharge (PbO)	lb.	.077-.08¾	.08¾-.09
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	11.50-12.50	..
Burnt (CaO) ground, in bulk	ton	8.00	..
Burnt, ground, in paper sacks	ton	10.00-11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15	2.30
Limestone ($CaCO_3$)		2.00	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.08
Manganese 85% (MnO_2)	lb.	.04	.04½
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	23.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08½	.09
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	06⅝	.07½
Hydrated 80-85%	lb.	.06	.06½
Potassium chromate (K_2CrO_4)	lb.	..	.26
Potassium hydrate (KOH) (caustic potash)	lb.	.07⅛	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.05⅞-.06
Potassium permanganate ($KMnO_4$)	lb.	.15	.16
Powdered blue	lb.	..	.24-.26
Rochelle salts, bbls.	lb.	..	.23
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	19.00-22.00	..
Selenium (Se)	lb	..	1.95-2.00
Silver nitrate (AgNO.)	(100 oz.) per oz.	..	.40¼
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½	..
In barrels	Per 100 lb.	1.55-1.57½	2.40
In bags	Per 100 lb.	1.37½-1.40	..
Spot orders.. .05 per 100 lbs. higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07¼
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb.	2.90	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04½
95 per cent	Per 100 lb.	2.15	2.40
Sodium selenite (Na_2SeO_3)	lb.		2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.38½	..
Tin oxide (SnO_2) in bbls.	lb.	..	.53
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb.	..	1.50-2.25
Zinc oxide (ZnO)	lb.	.06½-.08½	.12
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to June 23, 1928

	May 1927 Quantity	May 1927 Value	May 1928 Quantity	May 1928 Value	Five Months Ending May 1927 Quantity	Five Months Ending May 1927 Value	Five Months Ending May 1928 Quantity	Five Months Ending May 1928 Value
Glass and glass products (total)	.....	$733,741	.....	$842,320	.....	$3,625,941	.....	$3,949,936
Plate and window glass—								
Window glass, common, box 50 sq. ft.	1,258	9,277	2,165	11,495	8,200	50,132	7,215	42,323
Plate glass, unsilvered, sq. ft.	10,972	5,950	218,423	56,158	448 859	135,536	874,400	288,533
Other window and plate glass lbs.	580,063	66,979	319,469	30,145	1,899,523	184,158	1,387,846	165,944
Glass containers (bottles, vials and jars)	.....	252,745	.....	330,009	.....	1,195,244	.....	1,373,484
Table glassware, plain	.....	116,178	.....	107,738	.....	630,193	.....	539,157
Table and other glassware, cut or engraved	.....	15,137	.....	9,612	.....	58,932	.....	46,818
Lamp chimneys and lantern globes lbs.	147,078	36,496	182,183	31,535	881,665	186,295	862,270	168,941
Globes and shades for lighting fixtures lbs.	148,270	50,730	124,926	49,540	685,049	257,649	669,617	252,514
Chemical glassware lbs.	15,789	12,918	14,815	13,298	69,952	65,771	87,656	76,192
Electrical glassware, except for lighting lbs.	201,915	17,836	275,712	21,605	986,032	97,016	2,188,859	170,440
Other glassware	.....	149,495	.....	181,185	.....	765,015	.....	825,590

IMPORTS

Corrected to June 23, 1928

Glass and glass products	.....	$1,384,980	.....	$1,252,514	.....	$6,887,207	.....	$5,633,532
Cylinder, crown and sheet—								
Unpolished—								
Weighing less than 80 pounds per case dut. lb.	4,387,640	109,545	2,916,601	85,496	21,900,314	562,388	15,569,956	451,603
Weighing 80 pounds or over per case dut. lb.	4,095,518	164,400	3,041,840	131,390	17,904,154	810,355	14,596,367	635,370
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	28,645	.....	56,703	.....	167,149	.....	209,352
Plate glass—								
Polished, unsilvered dut. sq. ft.	1,701,444	435,750	1,662,686	350,972	7,316,520	2,215,564	6,730,011	1,473,057
Other dut. sq. ft.	141,693	22,685	120,825	33,941	478.288	121,621	474,344	117,203
Bottles, vials, jars, demijohns and carboys, molded or pressed dut.	.....	12,029	.....	14,298	.....	82,642	.....	82,536
Table and kitchen utensils dut.	.....	10,851	.....	28,004	.....	47,992	.....	112,841
Glassware, cut or decorated dut.	.....	274,795	.....	206,378	.....	1,355,704	.....	974,625
Blown glassware, n. e. s.—								
Bottles, ornaments, gauge glasses and other n. e. s. dut.	.....	64,064	.....	120,575	.....	306,405	.....	370,304
Bulbs for electric lamps dut. No.	789,870	8,876	676,284	7,097	6,368.635	58,902	5,226,986	54,574
Chimneys, globes, shades, prisms and other illuminating glassware dut.	.....	72,630	.....	71,567	.....	359,587	.....	367,208
Articles and utensils for chemical, scientific, and experimental purposes dut.	.....	50,819	.....	42,781	.....	217,754	.....	216,122
Other glassware dut.	.....	129,891	.....	103,312	.....	581,144	.....	568,737